THE TOWN OF MIDDLETOWN

RESOLUTION

OF THE

COUNCIL

No. .....

WHEREAS: The Federal Energy Regulatory Commission (FERC) has approved the Weaver's Cove LNG terminal project planned for Fall River, Massachusetts, and

WHEREAS: LNG tankers, traveling through Narragansett Bay, would directly impact the public safety, security and environment of the Town of Middletown, and

WHEREAS: The Middletown Town Council has twice passed resolutions in opposition to this proposal.

THEREFORE, BE IT

RESOLVED: The Town Council of the Town of Middletown is pleased to join its sister communities in the East Bay - the Towns of Bristol and Portsmouth and the City of Newport - in contributing to legal efforts to halt the project, and commits hereby a sum not to exceed $25,0000. toward retaining the legal services of Washington attorneys experienced in this field.

THE CITY OF NEWPORT

RESOLUTION

OF THE

COUNCIL

NO. 2005-112

WHEREAS, the Federal Energy Regulatory Commission (FERC) has approved the site for a Liquefied Natural Gas (LNG) facility in Fall River, Massachusetts; and

WHREAS, the public safety, security, environment, and economy of the communities of Rhode Island, particularly those bordering Narragansett and Mount Hope Bays, would be directly affected and negatively impacted; and

WHEREAS, the city of Fall River is preparing an appeal to halt the project and file a motion with the FERC for an evidentiary rehearing of the proposal; and

WHEREAS, Rhode Island municipalities have an opportunity to participate in the legal process; and

WHEREAS, it is in the best interest of Rhode Island communities, especially those directly affected, to join in a united effort to take any and all steps necessary to reverse the decision of the FERC allowing the LNG facility in Fall River, NOW, THEREFORE, BE IT

RESOLVED: the Council of the City of Newport does hereby join with other Rhode Island communities and commits up to $25,000 towards the retention of legal representation with expertise in the field of energy law in an effort to stop the development of the LNG facility in Fall River.

JOHN J. TRIFERO
STEPHEN R. COYNE

IN COUNCIL
READ AND PASSED
JUL 27 2005

Kathleen M. Silvia

~~Kathleen M.~~ Silvia
City Clerk

THE CITY OF NEWPORT

RESOLUTION

OF THE

COUNCIL

NO. 2004-20

WHEREAS, There is a proposal by KeySpan and BG LNG to ship liquefied natural gas to storage facilities in Providence, RI and Fall River and Somerset, MA, and

WHEREAS, the shipping routes would utilize Narragansett Bay and specifically travel through the East Passage corridor between Newport and Jamestown, and

WHEREAS, consideration for increased ship traffic, potential traffic disruption on the Pell Bridge and public safety risks must be discussed, and

WHEREAS, environmental and economic impacts and the need to consider alternative sources of fuel for the long term benefit of the residents of the northeast must also be explored. NOW THEREFORE BE IT

RESOLVED, that Council of the City of Newport hold a public forum inviting representatives of the Congressional delegation, Governor's Office, Economic Development Corp., KeySpan, BG LNG, Save The Bay, Waterfront Commission, Friends of the Waterfront, our local Legislative delegation, neighboring city officials, Newport officials and any additional interested citizens to discuss the impact of the proposed LNG storage facilities on our community and our harbor.

Richard E. O'Neill
Stephen C. Waluk

IN COUNCIL
READ AND PASSED
FEB 11 2004

Kathleen M. Silvia
City Clerk

THE CITY OF NEWPORT

RESOLUTION

OF THE

COUNCIL

No. 2004-104

WHEREAS, Weaver's Cove Energy is the name of the company currently proposing to construct a liquefied natural gas or LNG terminal in Fall River; and

WHEREAS, the proposal calls for the construction of a large LNG storage tank in Fall River and a huge trucking operation with up to 170 trucks traveling daily in and out of the Fall River site and along Route 79; and

WHEREAS, large LNG tankers would arrive every 5 – 7 days and deliver their cargo of liquefied natural gas to the Fall River site; and

WHEREAS, the tanker route requires that these tankers, which are about 940 feet long and about 150 feet wide, pass beneath the Pell, Mt. Hope, Braga and Brightman Street Bridges; and

WHEREAS, numerous Coast Guard ships and other vessels accompany the LNG tankers forming an exclusion zone around the tankers that prohibits any vessel or use of the waterway for up to 2 miles ahead of the LNG tanker and 1 mile to the rear with 1,000 yards of clearance necessary on either side of the vessel; and

WHEREAS, the proposed site is a totally inappropriate location whereby 9,000 residents are living within a 1-mile radius of the facility with the nearest residences 1,200 feet away from the storage tank and there are homes abutting the entire western side of the property and also five schools are within a 1-mile radius of the site; and

WHEREAS, Congress passed legislation in 1979 that specifically spoke to the need to site these types of facilities in remote areas. **NOW THEREFORE BE IT**

RESOLVED: that the Council of the City of Newport opposes the construction of the LNG terminals in Fall River and urge all the communities in the East Bay to support this Resolution.

RICHARD C. SARDELLA
JAMES W. BACCARI
KATHRYN LEONARD
JEANNE-MARIE NAPOLITANO
RICHARD O'NEILL
JOHN J. TRIFERO
STEPHEN C. WALUK

IN COUNCIL
READ AND PASSED
June 9, 2004

Kathleen M. Silvia

Kathleen M. Silvia
City Clerk

THE CITY OF NEWPORT

RESOLUTION

OF THE

COUNCIL

NO. 2004-181

WHEREAS, the Council of the City of Newport passed Resolution 2004-20 on February 11, 2004, calling for public discussion on the impact and safety concerns to the proposal by KeySpan to build a liquefied natural gas (LNG) terminal in Providence and a similar proposal by Weaver's Cove to build in Fall River, MA; and

WHEREAS, the Council of the City of Newport passed Resolution 2004-104 on June 9, 2004 opposing the construction of the LNG terminals in Fall River and urged all communities in the East Bay to support this resolution; and

WHEREAS, Resolution 2004-104 cited the frequency of LNG tankers, some 940 feet in length, traveling the waterways and passing beneath the Newport Pell Bridge in close proximity to our densely populated coastal community; and

WHEREAS, the resolution further indicated numerous Coast Guard ships and other vessels accompanying the LNG tankers would form an exclusion zone around the tankers prohibiting any vessel or use of the waterways up to two miles ahead and one mile to the rear and 1000 yards of clearance on either side of the LNG tankers; and

WHEREAS, the Federal Energy Regulatory (FERC) has acknowledged the seriousness of the consequences of a terrorist attack on an LNG facility and/or vessels traveling the waterways with heat levels that would be hazardous to people almost a mile away; and

WHEREAS, the same concerns exist with the construction of an LNG terminal in Providence that were cited in our opposition to the Weaver's Cove LNG facility in Fall River, MA. NOW THEREFORE BE IT

8/c

THE CITY OF NEWPORT

RESOLUTION

OF THE

COUNCIL

NO. 2004-181

RESOLVED, that the Council of the City of Newport opposes the constructionof the LNG terminal in Providence, RI and urges all the communities in the East Bay to support this resolution. AND BE IT FURTHER

RESOLVED, that the city administration express its concerns in writing to the Coast Guard by November 1, 2004 to the impact on recreational and commercial activities along Narragansett Bay caused by the LNG tankers traveling the waterways.

RICHARD E. O'NEILL

IN COUNCIL

READ AND PASSED

OCT 27 2004

Kathleen M. Silvia

Kathleen M. Silvia
City Clerk

6/2

THE CITY OF NEWPORT

RESOLUTION

OF THE

COUNCIL

NO. 2005 - 12

WHEREAS, the Federal Energy Regulatory Commission is considering siting liquefied natural gas facilities at locations in Providence, RI and Fall River, MA, and

WHEREAS, the liquefied natural gas tankers would travel through Narragansett Bay, and

WHEREAS, there are many unresolved public safety issues including, increased ship traffic, potential vehicular traffic disruption on the Pell Bridge and various environmental hazards. NOW THEREFORE BE IT

RESOLVED: that because of the potential impact of an environmental disaster, the Council of the City of Newport is opposed to the siting of any Liquefied Natural Gas facilities in Rhode Island and southeastern Massachusetts.

STEPHEN C. WALUK

IN COUNCIL

READ AND PASSED

JAN 26 2005

Kathleen M. Silvia

Kathleen M. Silvia
City Clerk

RESOLUTION OF THE BOARD
July 12, 2005

WHEREAS, the Newport County Chamber of Commerce is organized to advance the civic and economic vitality of Newport County and Rhode Island, and

WHEREAS, the Chamber's primary mission is to promote a healthy economic climate of goods, jobs, capital creation and honest, responsive government, and

WHEREAS, at the June 14, 2005 Board of Director's meeting held at the Newport County Convention & Visitor's Bureau, a discussion was held regarding the proposed applications made by KeySpan LNG, L.P. for authorization of a Liquefied Natural Gas (LNG) terminal located at Fields Point in Providence, RI and Weaver's Cove in Fall River, MA; and

WHEREAS, both facilities could potentially impact many of Rhode Island's coastal communities as LNG tankers travel north through Narragansett Bay en route to Providence as well as to Fall River, and pass under the Pell, Mt. Hope and Braga Bridges within close proximity to the coastlines of Newport, Middletown, Portsmouth, Tiverton and Bristol; and

WHEREAS, Newport and Narragansett Bay are home to Naval Station Newport which contains much of the United States Navy's senior officer training and undersea technology commands and the Chamber has worked diligently through the 2005 Base Realignment And Closure (BRAC) process to ensure that Newport and Rhode Island military commands are maintained at the highest level of military value, operations and security; and

WHEREAS, Newport and Narragansett Bay are home to yachting boatbuilding, sailing regattas, commercial and recreational fishing and similar marine trade activities which are an essential element of the Newport County and Rhode Island economy that could be severely disrupted by LNG tankers and their attendant security concerns: and

WHEREAS, the Cities and Towns of Rhode Island and state need to work jointly with the Commonwealth of Massachusetts to ensure that these proposals have no direct or indirect negative impacts on the present and future coastal commercial, residential and military projects along this fragile coastal corridor; and

WHEREAS, (a) there has not been a thorough security planning process involving all parties, (b) there has not been proper analysis of the energy needs of the New England region, (c) there may be alternate locations for such facilities and, (d) there is the potential to significantly burden the local public safety departments of these coastal communities.

NOW, THEREFORE, BE IT RESOLVED: that the Newport County Chamber of Commerce objects to the proposed expansion and/or development of the LNG terminals in Fields Point, Providence, RI and Weaver's Cove, Fall River, MA.

AND BE IT FURTHER RESOLVED, that the Chamber forward copies of this Resolution to the other Rhode Island Chambers of Commerce, Rhode Island General Assembly, Governor Carcieri and the Cities and Towns of Rhode Island.

The foregoing resolution was duly adopted by the Chamber Executive Committee on behalf of the Chamber Board of Directors on:

July 12, 2005

David A. Clopeck, Chair

TOWN OF PORTSMOUTH, RI

RESOLUTION #2005-08-09

WHEREAS: The Federal Energy Regulatory Commission (FERC) has approved the site for a Liquefied Natural Gas (LNG) facility in Fall River, Massachusetts, and

WHEREAS: LNG tankers would travel through Narragansett Bay, and

WHEREAS: the public safety, security, and environmental impacts would directly affect the three Aquidneck Island communities, and

WHEREAS: the City of Newport and the Towns of Middletown and Portsmouth have each passed resolutions in opposition to the sites of LNG facilities in both Providence and Fall River, and

WHEREAS: the City of Newport and the Towns of Middletown and Portsmouth are united in their opposition to the Fall River LNG facility.

NOW THEREFORE BE IT RESOLVED that the City of Newport and the Towns Middletown and Portsmouth strongly reaffirm their opposition to any LNG facilities in Providence and Fall River, and

BE IT FURTHER RESOLVED that upon passage of this Resolution by the three Councils, a joint Resolution bearing the official approval of the three Councils be forwarded to our Rhode Island Congressional Delegation, our State General Offices, our local members of the General Assembly and our neighboring East Bay communities.

ADOPTED August 9, 2005

Mary Ann Edwards,
President,
Portsmouth Town Council

ATTEST: Kathleen Viera Beaudoin,
Kathleen Viera Beaudoin,
Town Clerk

WARREN TOWN COUNCIL
RESOLUTION

Whereas: LNG is proposing an upgrade to their liquefied natural gas facility located in Providence, R.I. and in Fall River, MA. in order to allow LNG to convert the terminal to a facility capable of receiving marine deliveries; and

Whereas: The project would increase the site's current capacity of 150 million standard cubic feet per day to a total of 525 million standard cubic feet per day in a populated area; and

Whereas: The proposed site is an inappropriate location whereby residents and businesses are within a one (1) mile radius of the facility, allowing for a threat to the health, safety and welfare of those nearby: and

Whereas: Congress passed legislation in 1979 that specifically spoke to the need to site these types of facilities in remote areas,

Now, Therefore: be it resolved that the Town Council of the Town of Warren hereby opposes any expansion to the LNG facility and urge all the communities' throughput the State to support this resolution.

Frank J. Alfano

Frank J. Alfano, President
David S. Frerichs, Vice President
Louis A. Rego, Councilman
Christopher W. Stanley, Councilman
Joseph DePasquale, Councilman

Rita C. Palmieri
Town Clerk

April 26 2005
Date

February 1, 2005

The Honorable Patrick H. Wood
Chairman
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D.C. 20426

Dear Chairman Wood:

I write to urge you to reject proposals by KeySpan and Weaver's Cove Energy to establish liquefied natural gas (LNG) marine terminals in Providence, Rhode Island and Fall River, Massachusetts, respectively.

While I recognize that natural gas is an important and growing component of New England's energy supply, I am extremely concerned about the safety and security risks associated with siting LNG marine terminals in urban communities and requiring LNG tankers to pass by eleven Rhode Island towns and cities and more than 25 miles of densely populated coastline.

I and my colleagues in the Rhode Island delegation have attempted to work with the Federal Energy Regulatory Commission (FERC) to identify safer ways to deliver LNG to our region. Unfortunately, at every turn, FERC has rejected our efforts. The Commission refused to consider a regional approach to LNG terminal siting, one that would step back and take a comprehensive look at all the options, including offshore terminals, remote facilities that are being built in Canada, and other sites in the northeastern United States that are not in the heart of densely populated urban communities.

Not only did FERC reject these considerations, the Commission even denied our request to extend the public comment period on the Draft Environmental Impact Statement (EIS) for the KeySpan project, even though KeySpan did not object to the extension. Indeed, the 600-page document came out over the holidays, and the comment period closed on the day of a record-breaking snowstorm in New England.

FERC's approval process for LNG terminals is deeply flawed and leaves too many questions unanswered. We do not know exactly what impact the arrival and departure of 100 or more LNG tankers each year will have on recreational and commercial traffic on the Bay -- or whether any of our bridges will need to be closed during transits -- because the Coast Guard has not completed its safety and security reviews. I understand that the Coast Guard is working with KeySpan and with its state and local partners to complete those reviews, and I commend all the participants in the working groups for these ongoing efforts, but the Coast Guard has told my office repeatedly that it does not have the resources to adequately secure these LNG tankers and marine terminals while fulfilling its other post-911 responsibilities. This will require a whole new level of personnel and infrastructure, yet we have no cost estimate and no guarantee these new federal resources will be made available.

Similarly, a tremendous new burden will be placed on our state and local law enforcement and first responder agencies. I recognize KeySpan's commitment in its recent filing before FERC to develop a mechanism to provide recovery of "direct transit-related costs" faced by federal, state and local agencies "on a per-transit basis." I disagree with KeySpan's assumption, however, that other sources of funding will cover the bulk of additional costs associated with the security of the proposed KeySpan terminal. As stated above, the availability of new Coast Guard resources is very uncertain, particularly in the current federal budget climate. In addition, the federal grant programs KeySpan offers to help state and local agencies pursue are all facing dwindling resources, and at least one mentioned in the company's filing, the *Urban Area Security Initiative*, is not available to Rhode Island.

With all of these questions still unanswered, the public's opportunity to comment has now formally ended. FERC's legislative affairs office has informed my office that the Commission's staff is likely to go to print on the KeySpan Final EIS sometime after February 15th, in all likelihood prior to the completion of the Coast Guard's safety and security reviews. There is no justification for the KeySpan FEIS or the Weaver's Cove FEIS to proceed without incorporating the critical resource requirements that the Coast Guard will forward to FERC after completing both its waterways safety assessments and security workshops, not to mention the workshops for consequence management and emergency response planning that are just beginning in cooperation with the states of Rhode Island and Massachusetts. As the Army Corps of Engineers stated in its January 24th filing with FERC on the KeySpan project, "It is essential that your FEIS fully evaluate the Coast Guard plan and discuss potential navigation impacts and economic consequences both at the facility and as ships maneuver through Narragansett Bay."

I am also concerned about the underlying safety standards for LNG facilities and the KeySpan proposal's compliance with those standards. The 1979 Pipeline Safety Act directs the Secretary of Transportation to consider the "need for remote siting" of LNG terminals, but the Department's safety regulations (49 CFR 193) fail to address this statutory requirement. Moreover, the National Fire Protection Association standards that DOT uses for LNG terminals (NFPA 59A) were written prior to September 11, 2001 and do not even mention a terrorist attack as one of the possible emergency scenarios. The DOT regulations and the NFPA standards do, however, require KeySpan and other LNG plant operators to have in place procedures that address an "uncontrollable emergency" and the "possible need for evacuation of the public in the vicinity of the LNG plant." What specific steps have been taken by KeySpan to comply with 49 CFR 193.2509(3), which calls for "coordinating with appropriate local officials in preparation of an emergency evacuation plan, which sets forth the steps required to protect the public in the event of an emergency, including catastrophic failure of an LNG storage tank"? Will such a plan be addressed in the FEIS?

I am particularly concerned that KeySpan's facility, which has operated for 30 years under the grandfather provision of the Pipeline Safety Act of 1979, may be substantially modified to establish a marine terminal without bringing the plant up to current federal safety standards. Indeed, FERC's Draft EIS states that "the current proceeding provides the opportunity to re-evaluate the existing facility and to raise the level of safety to that required for new LNG facilities." I am disappointed that KeySpan's response to FERC argues that in virtually every area mentioned by the Commission, including Thermal Radiation Exclusion Zones, Vapor Dispersion Zones, Impoundment

Capacity, Seismic Design Requirements, it would not be "practically or economically feasible" for KeySpan to comply with new construction standards.

I want to emphasize that I appreciate the important role LNG plays in Rhode Island's energy infrastructure, and I look forward to continuing to look for alternative means to increase the supply of natural gas to our region. It is regrettable that the lingering questions about safety and security standards for LNG, as well as FERC's unwillingness to work with Rhode Island's congressional delegation on comprehensive, regional solutions to our natural gas supply challenges, have brought us to the point where I must oppose the proposed KeySpan and Weaver's Cove LNG terminals.

I look forward to working with you to explore other means, including offshore facilities, to bring more natural gas to our region while minimizing the risk to our citizens.

Thank you for your attention to this matter.

Sincerely,

Jack Reed
United States Senator

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

In the Matters of:	:	
	:	
Weaver's Cove LNG, L.L.C.		**FERC Docket Nos.: CP 04-36-000**
Mill River Pipeline L.L.C		**CP 04-41000**

Testimony of

John Torgan

PRIVILEGED AND CONFIDENTIAL

ATTORNEY WORK PRODUCT – PREPARED IN THE CONTEXT OF LITIGATION

DRAFT TESTIMONY OF JOHN TORGAN, NARRAGANSETT BAY KEEPER FOR THE ENVIRONMENTAL GROUP SAVE THE BAY

Q. Please state your name and business address.

A. John Torgan, Narragansett BayKeeper, Save The Bay, 100 Save The Bay Drive, Providence, Rhode Island 02905.

Q. Please summarize your educational background.

A. B.S. in Environmental Studies/Biology, Union College, NY, 1991; Masters Candidate, Department of Marine Affairs, University of Rhode Island, 2006.

Q. Do you additionally do research, publish and/or speak at professional symposia regarding Narragansett Bay and your activities therein, and/or have you otherwise patrolled Narragansett Bay as part of the discharge of your various duties?

A. In my capacity as Narragansett BayKeeper for Save The Bay, I have patrolled the waters of Narragansett Bay since 1994, using Providence as my home port. BayKeeper is Save The Bay's direct action, response and advocacy program designed to prevent pollution and promote sustainable uses of the Bay and its rivers. I have served on numerous State, local, and national dredging commissions and committees, including the RI Governor's Task Force on Dredging in its various iterations from 1994-the present. I am a founding member of the Rhode Island Inter-agency Dredging Team, a group that includes state and federal agencies as well as industry groups. I led Save The Bay's response to the 1996 North Cape oil spill, and earned designation of the organization as the State of Rhode Island's lead agency for the coordination and management of volunteers for oil spills. In 1997, I co-chaired the regional panel called the

Regional Risk Assessment Team comprised of Coast Guard, industry groups, state regulatory agencies, and environmental groups from New Jersey to Maine to develop regional safety standards for tank barge shipping. I have testified on the subject of oil pollution and response before the states of Rhode Island, Massachusetts, and the United States Senate. I have participated on four committees of the National Academy of Sciences Transporation Research Board dealing with marine transportation safety and risk, including a committee in 2003 on the Federal Role in Marine Transportation Systems. I was a member of the National Academy of Sciences Committee on the development of a process for Setting, Managing, and Monitoring Environmental Windows for Dredging Projects (2001). I participated in the drafting of the US Coast Guard Area Contingency Plan for Marine Safety and am a member of the Area Committee for Marine Safety. I have served as Save The Bay's spokesman on these issues since 1994.

Q. Please describe the mission and/or goals of Save The Bay.

A. Save The Bay is Southeastern New England's largest non-profit environmental organization. With more than 20,000 members, the mission of Save The Bay is to protect, preserve, and restore Narragansett Bay and its rivers from the harmful effects of pollution. The organization was founded in 1970. Narragansett BayKeeper was the eighth of 155 WaterKeeper programs to be incorporated into the Water Keeper Alliance, now an international environmental organization. River and BayKeepers serve as independent, non-government environmental advocates and authorities for their water bodies.

Q. Do you have experience performing environmental studies on the Taunton River in the vicinity of the Weaver's Cove Project?

A. Yes.

Q. What is your particular experience with respect to the quality of the environment in the vicinity of the project site?

A. I have participated in water quality studies both sponsored by Save The Bay and by agencies, universities, and private partners such as contractors for the Brayton Point Station, a major power plant located near the proposed Weaver's Cove facility. Additionally, I participated on the Technical Advisory Committee for the Brayton Point Station from 1994-1998, on a special committee formed by EPA to assess the scientific studies performed to assess the impacts of Brayton Point on fish populations. More recently, I have served on the Taunton River Wild & Scenic Study Committee (2003-2006), a coalition of groups from throughout the Taunton River Watershed in Massachusetts and Rhode Island seeking Federal Wild & Scenic designation from the National Parks Service.

Q. What specific parameters did you test for?

A. We mostly tested for dissolved oxygen, salinity, temperature, and other physiographic water quality indicators. I also have tested for nitrogen and other biological criteria.

Q. Please describe your understanding, in detail, of the ecological health and importance of the Taunton River in the vicinity of the project site?

A. The Taunton River is an estuary of national importance. Despite historic pollution, it remains a vital and essential portion of the Narragansett Bay ecosystem. The Lower Taunton River and Mount Hope Bay estuaries are particularly important to larval and juvenile fish. The Nature Conservancy has identified the Taunton as a globally rare system and as a national priority conservation target. The Wild and Scenic River Study Committee worked to compile current information on many of the River's cultural and natural assets. The attached final report includes documentation of:

- More than 154 species of birds along the river during breeding season, including bald eagles.
- River otters active along the banks of the river.
- Seals in the upper portion of the Taunton River.
- 29 species of native fish, including native brook trout.
- The very rare native sturgeon, which can grow to 14 feet long, has been found in the lower Taunton.
- The Nemasket River is the state's largest Alewife fish run.
- The Taunton River hosts 7 species of freshwater mussels, making it among the most diverse waterbodies in the state for this rare group of animals.

Q. Are you familiar with the dredging component of the Weaver's Cove proposal?

A. Yes.

Q. Do you believe the dredging project for Weaver's Cove LNG, as proposed, can be performed in accordance with the Clean Water Act and have only temporary, insignificant impacts to river life?

A. No. As indicated in my testimony before the Army Corps of Engineers testimony of December 5, 2005, this dredging will have a permanent and severe impact on the ecology of the Taunton River. Excerpts of that testimony follow:

> Save The Bay believes that this project would result in unacceptable, severe, and permanent impacts to the Taunton River and Mount Hope Bay. These impacts would be a direct result of the dredging and dredge disposal components of the project. We respectfully disagree with the conclusions of FERC staff in the FEIS that "Weaver's Cove Energy has designed its proposal to mitigate most of the adverse environmental impacts..." and that "(FERC) has developed, as appropriate, specific mitigation measures to reasonably avoid or minimize those impacts"[1]. In fact, the project would cause permanent and irreversible loss of critical habitat and impact the migratory and spawning ecology of marine species. Despite this, the applicant has not proposed any mitigation whatsoever to offset these losses of public trust resources.
>
> The FEIS refers to direct impacts to approximately 200 acres of submerged habitat. The "mitigation" referred to in the FEIS allows a net loss of submerged and wetland habitat including spawning habitat for locally depressed populations of winter flounder, quahogs, and tautog, and does nothing to ensure any environmental or public benefit. The project offers clear economic benefits to the private applicant and no public compensation nor environmental restoration. Simply observing dredging windows does not constitute mitigation and will not adequately protect marine species in the Taunton

[1] Final Environmental Impact Statement Vol I, Weaver's Cove LNG Project, May 2005 @ p.ES-14

River, all of which will have to pass through the impacted areas not only during project construction, but permanently thereafter.

Comparing this proposed project to the Providence River and Harbor Maintenance Project is totally inappropriate and the perceived success of the Providence River Project may not be used to predict the expected impacts of Weaver's Cove. First of all, the Providence Project was a maintenance project for an existing federally-designated channel. The Providence River project was for an expressly public purpose, and the disposal strategy was developed specifically to address the problems posed by shoaling in the authorized channel. Weaver's Cove is a private project that will perform deepening and new dredging to create a turning basin in an area of the Taunton River for a sole beneficiary- the applicant. The vestigal channel that exists north of the Braga Bridge would not be dredged if not for this applicant. Characterizing this dredging as a public navigational safety benefit is misleading, since it will increase tank vessel traffic in an area that presently experiences little commercial vessel traffic. Dredging will allow more and larger vessels to come up into the Taunton River, increasing risk of collisions and other marine casualties.

If there is a lesson to the Corps from the Providence River project, it should be that Narragansett Bay and its tributaries are highly valued by Rhode Island and Massachusetts, and that these states are willing to pay more and wait longer for environmentally-sound dredging. The lesson should not be "just observe windows and there is no impact"; Rather it should be "anything bad for Narragansett Bay is a non-starter".

The conclusion in the FEIS that "implementation of our aquatic resource recommendations would avoid or minimize impacts on winter flounder by prohibiting dredging during the spawning period and would mitigate the permanent loss of winter flounder habitat and impacts on quahog within the proposed turning basin," is incorrect. How does avoiding dredging during the (peak) spawning period mitigate permanent loss of spawning, nursery and foraging habitat? In fact, the creation of a deep channel and turning basin will compound and exacerbate existing low dissolved oxygen conditions in the river and likely lead to chronic hypoxia in the bottom waters. Presently, these shallow areas outside the dredged channel are typically not hypoxic, yet recent studies confirm that hypoxic and anoxic conditions do exist seasonally in the dredged channel in Mount Hope Bay and the Lower Taunton River.[2] The deepening of the Taunton River in the turning basin has a high likelihood of causing these low oxygen conditions across the entire river in the vicinity of the project, forcing animals to swim a narrow gauntlet between two coal-fired power plants (Brayton Point, and Montaup) and this LNG facility in order to reach suitable habitat.

The continuing operations of Dominion Energy's Brayton Point Station already chronically impact this area of the Bay. This power plant has been implicated in an 87%

[2] MA 303(d) listing, 2005 and continuing studies by the University of Massachusetts SEMAST program confirm low dissolved oxygen and stratification in the dredged channels of Mount Hope Bay. Additional studies at http://www.geo.brown.edu/georesearch/insomniacs/ confirm these conditions.

decline in fish populations in Mount Hope Bay observed since 1986.[3] One of the fundamental flaws of the FEIS is that it does not address cumulative impacts, including the many pollution sources that already have compromised the natural conditions of the lower Taunton River and Mount Hope Bay. Brayton Point, the Fall River Wastewater Treatment facility and the more than 10 communities in the Taunton River watershed have either made commitments to upgrade river water quality or are under legal and regulatory requirements to do so. Brayton Point's owners are appealing an EPA permit that requires a 95% reduction in heat and flow from the plant, but will soon be forced into compliance. Fall River has already implemented the first phase of its combined sewer overflow abatement project and is investing significant capital in riverfront improvements. Still, the Lower Taunton and Mount Hope Bay are in relatively poor ecological health, as evidenced by high nutrient and bacteria levels and depressed native fish populations.

Save The Bay believes that the further impacts posed by the proposed LNG project need to be considered in light of the full range of data that exists on the condition of the resource. Under NEPA and the Clean Water Act, this applicant may not further degrade the condition of this waterway. This is particularly important in light of the broad efforts and investment to restore the Taunton River.

This project is directly interfering with efforts to designate the Taunton River as a National Wild and Scenic River through the National Park Service by making the designation a political issue. The Wild and Scenic Rivers process was the culmination of many years of hard work by the communities, and it aims to improve, protect and restore the health of the river. This LNG project will degrade water quality, and make the river a weaker candidate for the prestigious recognition it deserves. If permitted, the construction and operations of this LNG facility will make it difficult even to access the Taunton River by boat in the vicinity of the project. The security regime that will be required each time an LNG tanker transits the Bay and offloads its cargo will interfere with other commercial and recreational navigation throughout the East Bay.

Q. What other direct environmental impacts might this dredging project pose?

A. The dredging will have 3 major classes of impacts: 1) Suspension of sediments, 2) Burial of habitat at the disposal site, and 3) Excavation of a deep channel that is more likely to become seasonally hypoxic than the existing condition.

---

[3] Gibson, M.R. 1996. Comparison of trends in the finfish assemblage of Mt. Hope Bay and Narragansett Bay in relation to operations at the New England Power Brayton Point Station. RI Division Fish and Wildlife Research Reference Document 95/1. Revised August,1996

1) First, the dredging itself will suspend sediment into the water column. Some of the sediments in the vicinity of the project site are known to be contaminated with mercury. The applicant has waived testing of the most contaminated sediments around the project site opting for upland disposal, but Save The Bay is concerned that it may reach concentrations that exceed water quality standards during and immediately following dredging. This could harm migratory fish.

2) The proposed disposal site, in Rhode Island Sound, has limited capacity and was designated and intended to be used for Rhode Island dredging projects serving navigation or the public interest. Clearly, this is a Massachusetts-based project and its use of the Rhode Island Sound disposal site will cause impact to the Rhode Island environment via burial of benthic organisms at the disposal site. The material to be dredged for Weaver's Cove is more than 75% fine-grained, and may not be appropriate for the naturally coarser substrate at the Rhode Island Sound disposal site. It will also use up capacity, all without any compensation to Rhode Island for use of these public trust resources.

3) As discussed above, the potential for hypoxia will be increased by this project. This is a serious project deficiency. NEPA requires disclosure of "any irreversible and irretrievable commitments of resources which would be involved in the proposed action" (NEPA 42 USCA 4332). The EIS fails to account for the permanent alteration, conversion, and loss of estuarine habitat. The EIS does not propose any mitigation for these takings. We believe the Army Corps of Engineers is therefore compelled to deny the dredging permit for Weaver's Cove.

Dated: February 8th 2006

John Torgan
Narragansett BayKeeper
Save The Bay

State of Rhode Island
County of PROVIDENCE

Subscribed and sworn to before me this 8th day of February, 2006 by John Torgan.

Stanley G. Dimock
STANLEY G. DIMOCK NOTARY PUBLIC
MY COMMISSION EXPIRES 8/1/09

John Torgan
Narragansett BayKeeper
Save The Bay

CERTIFICATE OF SERVICE

I, the undersigned, hereby certify that a copy of the within was mailed, postage prepaid, on this _____ day of February, 2006 to those indicated below:

PSH
PARTRIDGE SNOW & HAHN LLP
COUNSELORS AT LAW

Robert

B

RECEIVED
JUN 07 2005
Executive Office
Department of Attorney General

June 7, 2005

VIA HAND DELIVERY

The Honorable Patrick C. Lynch
Attorney General
State of Rhode Island and
Providence Plantations
150 South Main Street
Providence, Rhode Island 02903

Re: Application of Weaver's Cove Energy LLC

Dear Mr. Attorney General:

This is in response to your letter dated May 24, 2005 regarding the Weaver's Cove Energy, LLC matter and my letter to you dated April 29, 2005. As to Weaver's Cove's application for a Category B Assent, that application was filed with the Rhode Island Coastal Resources Management Council on July 19, 2004. Similarly, an application for a Section 401 Water Quality Certification was filed with the Rhode Island Department of Environmental Management on July 19, 2004.

Sincerely,

John M. Boehnert

JMB:mjo
cc: Mr. Ted Gehrig
Bruce F. Kiely, Esq.
Mr. Terrence Tierney, R.I. Attorney General's Office
Mr. Michael Rubin, R.I. Attorney General's Office

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DIRECT TESTIMONY OF RICHARD A. CLARKE

Q. Please state your name, current positions, and business address.

A. My name is Richard A. Clarke. I am Chairman, Good Harbor Consulting, which is located at 4100 Fairfax Drive, Suite 301, Arlington, Virginia 22203.

Q. Mr. Clarke, what is your purpose in appearing as a witness in this proceeding?

A. Over the past several months I have become increasingly aware of the threat to national security and to public health that would be presented if the Commission were to certify either the KeySpan or Weaver's Cove facilities, which have been proposed for location within Providence, Rhode Island and Fall River, Massachusetts, respectively. In fact, following an intensive study of the situation that would exist following certification and commercial deployment, including of the attractiveness of the facilities and of their associated tanker traffic as terrorist targets, the inability to eliminate the potential for successful terrorist attack, and the horrendous consequences that would follow such an attack, I have reached the judgment that were the Commission to authorize either of those projects to go forward it would be taking actions entirely at odds with the lessons that should have been learned from 9/11 and it would be exposing large segments of the public to horrific, but entirely avoidable, harm. I could think of few actions that our government could take that would be as prejudicial to the public. I felt, therefore, that it was incumbent that I share by conclusions and my concerns with the Commission and that is why I agreed to submit this testimony and to make my

self available to help assure that the only appropriate disposition is reached, rejection of the KeySpan and Weaver's Cove requests.

Q. Before you describe for us how you first became involved with the KeySpan and Weaver's Cove applications and the investigative effort that that involvement precipitated, please summarize your educational and professional background.

A. I am a graduate of the University of Pennsylvania, and I attended the Massachusetts Institute of Technology. In 1973, I went to work in the Office of the Secretary of Defense. In the Reagan Administration, I became the Deputy Assistant Secretary of State for Intelligence, and in the George H.W. Bush Administration, I served as the Assistant Secretary of State for Politico-Military Affairs. In 1992, I was appointed by the National Security Advisor, General Scowcroft, to the National Security Council Staff, where I continued to serve throughout the Clinton Administration, and during the George W. Bush Administration until January, 2003. After leaving the Government, I founded Good Harbor Consulting, LLC, which provides strategic planning, product and business strategy evaluation, and corporate security risk management services.

Q. When and by whom were you first contacted with respect to either the KeySpan or the Weaver's Cove proposals?

A. The Attorney General of Rhode Island, Patrick Lynch, contacted me in January with respect to concerns that he had about the KeySpan proposal.

Q. At that time did Attorney General Lynch ask you to be a witness appearing in opposition to the KeySpan project?

A. At that time there was no discussion at all about my appearing as a witness. As I understood the Attorney General's request, he wished to know whether the concerns that he had were legitimate.

Q. Did you offer any judgments at that time?

A. No. The Attorney General told me that he was concerned about the safety implications that might be associated with the location of an LNG facility in a populated area like Providence and the presence of LNG tanker traffic in congested in-land waterways. He asked whether I shared those concerns. I told him that I would be unable to reach a definitive judgment until I investigated the matter in some depth and, at his request, I agreed to commence that investigation.

Q. How did you proceed to place yourself in a position to be able to draw conclusions?

A. I was advised by the Attorney General that he thought it advisable to share any judgments that I might reach with the decisionmakers and if that were to occur I would have to complete my analysis before the Coast Guard completes its own assessment. The Attorney General indicated that he would request that the Coast Guard withhold completion of its effort until my study could be completed. Subsequently, I was advised that the Coast Guard had agreed to hold its record open until May 9 and that if my report were completed prior to that date it would be considered. With that schedule in mind, I organized resources that are available to me, specifically I solicited and received the support and participation of several graduate students at the Kennedy School of Government at Harvard University and at the Fletcher School of Law and Diplomacy at Tufts University

who were enrolled in my course focused on terrorism, intelligence, and homeland security. We developed a five-part approach to assessing the risks posed by terrorist organizations, examining 1) whether terrorist groups have indicated an interest in attacking targets of the type under consideration; 2) whether terrorist groups have or could easily obtain the means necessary to conduct a significant attack on the class of target under review; 3) whether and to what extent the class of target has significant vulnerabilities to attack, with and without mitigation; 4) what the consequences of an attack would be and whether the affected communities would have the capacity to respond; and 5) what the costs and timing of recovery would be. The traditional method of risk assessment – calculating the probability of attack based on the past frequency of attack – is clearly no longer adequate to the challenges we face, and would have found that the risk of terrorists hijacking commercial aircraft and flying them into the World Trade Center was zero

Q. Did your investigation include visits to any of the affected areas?

A. Yes. I took a helicopter tour of the routes the LNG carriers would take, both to the proposed KeySpan project and to the proposed Weaver's Cove project. From the air, then, I saw the site for the Weaver's Cove project, the LNG carrier routes, and the adjacent land areas.

Q. Can you estimate for the Commission the level of effort that your undertaking entailed?

A. I estimate that the report required approximately 800 man-hours of time.

Q. Were you compensated for the study effort or for the preparation of the Report?

A. I was not. The effort was undertaken pro bono publico.

Q. Did your investigation culminate with the Preparation of a Report?

A. It did. On May 9, 2005 I presented to Attorney General Lynch my Report entitled "LNG Facilities in Urban Areas -- A Security Risk Analysis for Attorney General Patrick Lynch, Rhode Island" ("Report"). A copy of that Report is attached as Exhibit A to this testimony.

Q. Please summarize the principal conclusions that you reached following your investigation.

A. Although the implications are profound, the conclusions can be summarized quite simply. First, the location of an on-shore LNG facility in an urban environment and the passage of LNG tankers along populated in-land waterways would present an exceedingly attractive target for terrorists, the very type of target that terrorists have identified for priority consideration. Second, it simply is not possible to conclude that those types of targets can successfully be defended from terrorist attack. Third, the consequences of a successful attack could well exceed in fatalities, in the infliction of unimaginably painful life-long injuries, and in the destruction of infrastructure, even the consequences of the attacks of 9/11.

Q. Why do you say that the location of an on-shore LNG facility in an urban environment and the passage of LNG tankers through populated in-land waters would present terrorists with targets of opportunity that they are likely to find highly attractive?

A. I start from the proposition that while it may not be possible effectively to measure the probability of a terrorist attack, the possibility of such an attack is

now a foreseeable risk within the United States. That being the case it behooves us to minimize the opportunities that would be most attractive to terrorists precisely because of the catastrophic consequences they offer. An urban LNG facility would necessarily rank high on any terrorist's list of target opportunities. This is not a matter of speculation. We know that organized terrorists groups have long identified components of energy infrastructure as desirable targets. We know that tanker traffic, and in particular energy laden tanker traffic, has similarly been identified. And we know that when it comes to identifying targets of opportunity, the ability to inflict maximum human suffering, maximum economic loss, and maximum chaos factor heavily into the terrorist mindset. All of those objectives would be achieved were terrorists to succeed with an attack on either the KeySpan or the Weaver's Cove facility or on LNG tankers while traveling to or from those installations.

Q. I note that in your last response you drew the same conclusion for both the KeySpan and the Weaver's Cove proposal, yet your Report addresses only the former. Are you unfairly extending the message of your Report?

A. Absolutely not. It would be inappropriate to read my Report as applying to the KeySpan proposal but not to that of Weaver's Cove. The broad conclusions are applicable to each. The site specific quantification that is included in the Report is specific to the KeySpan proposal, but that is simply a result of our utilization of that proposal as the basis for analysis. The conclusions about the inappropriateness of the location of an LNG terminal within an urban center apply equally to the Weaver's Cove proposal and, of course, the implications of the

tanker traffic would be precisely the same as both proposals would require tankers to traverse the same basic waters. The only differences that would exist would be the extent of the body count, of the numbers injured, and of the infrastructure that would be destroyed, depending on where the successful attack were to occur.

Q. On what basis do you conclude that organized terrorist groups have identified energy infrastructure as attractive targets for attack?

A. First, al-Qaeda already has launched an attack on an energy facility. On October 6, 2002, a small boat loaded with explosives was rammed into the French supertanker Limburg while carrying a cargo of 400,000 barrels of Saudi crude through the Gulf of Aden. This attack, and the similar attack against the USS Cole, is of particular significance due to the presence of an extraordinary number of small crafts in the in-land waters of Rhode Island and Massachusetts that would be the area of tanker traffic. I will have more to say about that subject a bit later on. Second, terrorist groups are undoubtedly aware of the reality that there have been breaches of containment at LNG facilities, both in the United States and elsewhere, resulting in significant losses of life. While the earlier instances were occasioned by accidents, the damage potential that they legitimatize will not be a lesson lost on terrorists. Third, LNG supplies originate from areas that are politically unstable and that host intensive terrorist activity enhancing the possibility that timed or remotely activated explosive devices could be hidden on tankers and remain undetected. Fourth, as I say in the Report, "[t]he potential disaster that would result from an attack on a LNG tanker or facility could be of the 'spectacular' nature that groups like al Qaeda are keen to produce," namely

attacks that would inflict maximum human suffering, economic and infrastructure damage, and that would trigger wide-spread panic and loss of confidence in the ability of government to mount an adequate defense. It is not without reason that the Department of Homeland Security ("DHS") recently identified an attack on a chemical or gas tanker as the number six ranked doomsday scenario for the government of the United States. The presence of a chlorine facility in close proximity to the KeySpan site only adds to the potential terror that might be associated with an attack.

Q. Why is it inadequate to establish a safety or security zone around a tanker while it is in transit through in-land waters?

A. Safety or security zones are useful in preventing accidents but they are just about worthless when it comes to the avoidance of intentional attack. Leaving aside for the moment the potential for underwater attack, the premise of a safety or security zone is that it in fact would be respected. That is fallacious when it comes to terrorists. The in-land waters of Rhode Island and of Massachusetts through which these tankers will have to pass are both close to the shoreline and pass in close proximity to what is perhaps the densest population of marinas and anchorage to be found anywhere in the world. That proximity means that a craft could be launched and reach a tanker in but moments. Assuming that escort vessels were able to apprehend that threat, would they have time to take preventative action, and would they be willing to do so in light of concerns for the safety of nearby civilians? My own judgment is that the reaction time might not be sufficient, particularly if, as I would think likely, the terrorists would

accompany the attack on the tanker with an initial assault upon or effort to divert the attention of the escort vessels. Moreover, neither safety or security zones nor an armed flotilla offers any protection from a land-based attack. Through most of the approximate 26 and 31 mile passages to Providence and to Fall River the tankers would be in close enough proximity to the shore to permit hostile activity anywhere along miles and miles of shoreline, some heavily populated, some sparsely populated but providing ground cover conducive to hostile activity. We provide a considerable amount of detail on the magnitude of this shore-based threat to tanker traffic in the Report. Finally, there is the potential for an underwater assault. While this would be somewhat challenging while a tanker is in transit, even then it would remain a credible threat. We know that organized terrorist groups are becoming increasingly sophisticated in their deployment and utilization of scuba equipment as an attack option. The complexity of an underwater attack would of course be lessened considerably when a tanker is at the terminal or is executing a required 180 degree turn.

Q. Would it not be possible to minimize the threat by confining the passage of the inland waters to early morning or evening hours when it can be expected that marine traffic would be at a minimum?

A. I imagine that it would if the concern were limited to accidents. But that limitation would do nothing to lessen the potential for a terrorist attack. If anything, it would make surveillance, particularly of potential on-shore sniper sites, much more difficult.

Q. Would the presence of airports in the area, including those devoted to general aviation, raise any concerns?

A. Most definitely. One of the many concerns that we highlight in the Report is the proximity to airfields. We identified no less than 9 airfields that are within a 33 nautical mile radius of Providence and I have been advised that there are even more airfields within fewer miles of Fall River. As we make clear in the Report, "[a]n air attack conducted using a small plane could occur along any portion of the ... transit route. Defense against an air attack [is] nearly impossible." Report at 83. We were all recently reminded of the threat when a high alert was called in Washington as the result of the breach of restricted air space by a small plane. In that circumstance, it was possible to send attack planes aloft. It is unrealistic to imagine the same warning or attack capability along the inland waters of Rhode Island and Massachusetts. Nor does it make sense to create a circumstance where it might be necessary even to contemplate shooting down a plane over congested waters or populated land areas, particularly as it is likely that a plane associated with a planned terrorist attack would be laden with explosive devices.

Q. With respect to the threat of attack from the shore or from a bridge, must it be assumed that terrorists would have access to weaponry of sufficiently destructive capability as to be able to trigger a breach of containment of sufficient magnitude to precipitate an event of catastrophic magnitude?

A. It absolutely must be so assumed. The experts that I have consulted, and the expert studies that I have read, indicate that a breach of containment sufficient to cause rapid spillage of as much as 3,000,000 gallons of LNG, which would be

sufficient to trigger a pool fire of sufficient severity so as to place anyone within one mile or perhaps more in immediate peril of sustaining second degree burns, or worse, is easily within the capabilities of even a moderately sophisticated terrorist. As discussed in the Report, weaponry available to terrorists is capable of inflicting that extent of damage from as far away as 1500 feet or more.

Q. In several of your prior answers you were addressing, in particular, the threat to tanker traffic. Would the same threats be posed with respect to the on-shore facilities that are proposed for the KeySpan and Weaver's Cove sites?

A. They would. The on-shore sites would be no less vulnerable to land or water-based threats nor would they be immune to air strikes. As is the case with respect to tanker traffic, to assume that adequate protection can be provided by positioning security personnel around the site would be fanciful and ignores the considerable distances from which a successful attack could be launched.

Q. As part of your investigative effort, was any attempt made to quantify the damage that could be associated with a successful attack?

A. Yes, but primarily for the reason of answering whether the potential for visiting upon the public sufficient devastation and destruction as to heighten the attractiveness of the KeySpan and Weaver's Cove facilities and tankers as targets. The answer, as detailed in the Report, is a resounding "Yes". In reaching that judgment it was necessary that I familiarize myself with, among other matters, the level of thermal radiation that might be associated with a post-containment breach LNG fire and population densities within certain proximities to that breach. As we confirmed, literally thousands of lives would be at imminent peril. For

purpose of my testimony, I leave to others, specifically to Drs. Havens and West, explanation of the pool fire and vapor dispersion phenomena that can be expected to follow a breach of containment, and to local officials from Providence and Fall River to detail the populations that could be impacted and the emergency facilities that would be available to respond.

Q. Mr. Clarke, if you were the decisionmaker in this proceeding, what would you have to assume about the potential for a successful terrorist attack at either the KeySpan or Weaver's Cove terminal site or at a tanker serving one of those sites, that could precipitate catastrophic consequences?

A. I would be forced to conclude that the risk of attack is high and that it simply would not be possible adequately to safeguard against the success of such an attack.

Q. Do you have any final thoughts that you would like to share with the Commission?

A. I do. It is not often that those with positions of authority in government have the luxury of being able to take action that can remove a certain threat from the public. Yet that opportunity is presented to the Commission here. I recognize fully that the Commission also must be concerned about the adequacy of energy supplies and I have been made aware of the need that exists in the New England region for added supplies of natural gas and of the fact that some of that added gas will have to be supplied by LNG. But I have also been told that it is technologically possible to site LNG delivery points miles off-shore far removed from population centers. If that in fact is the case then it seems to me that the

choice is an easy one even assuming that the offshore facility would carry a higher additional cost, something that I do not know but am willing to accept for the purpose of discussion. In most respects protecting an offshore facility would be far easier, because it would be easier to maintain and enforce a safety or security zone in the ocean than in the midst of an urban center. There would be no concern about attacks from nearby buildings or shorelines, and threats from the air could both be more easily recognized and could be dealt with without threatening civilian populations. Indeed, the very remoteness of the offshore facility would make it a significantly less attractive terrorist target. Finally, on the issue of comparative cost, a successful attack in or around Providence or Fall River would quickly render any issue of comparative economics moot. Indeed, it surely would embarrass those who allowed comparative economics to influence so fundamental a matter of national security and public well-being. If either the KeySpan or the Weaver's Cove facility had been placed in operation prior to 9/11 we would today be ruing the decisions that made that possible. As a nation we have enough threats in our midst with which to deal. Although we are more than three years removed from 9/11, we have yet to protect adequately against the hazards that are all around us. It is inconceivable to me that we would sanction so significant an exacerbation of our existing preventative challenge. It is inconceivable to me that any public official could conclude that authorization of either the KeySpan or Weaver's Cove facility would be consistent with preservation of the public interest.

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Weaver's Cove Energy, L.L.C. and	)	Docket Nos. CP04-36-000, CP04-41-000,
	)	
Mill River Pipeline, L.L. C.	)	CP04-42-000, and CP04-43-000
	)	

DECLARATION OF WITNESS

I, Richard A. Clarke, declare under penalty of perjury that the statements contained in the Direct Testimony of Richard A. Clarke on behalf of the City of Fall River and the Attorney General of the Commonwealth of Massachusetts in this proceeding are true and correct to the best of my knowledge, information, and belief.

Executed on this 6th day of June, 2005.

s/ Richard A.Clarke

Exhibit A

(Already filed with the Commission)

Direct Testimony of Bruce S. Auerbach, MD, FACEP

Q. Please state you name and business address.

A. My name is Bruce Auerbach, and my business address is Sturdy Memorial Hospital, 211 Park Street, Attleboro, MA 02703.

Q. Dr. Auerbach, in what capacities are you employed at Sturdy Memorial Hospital?

A. I am Vice President and Chief of Emergency and Ambulatory Services.

Q. What is your purpose in offering testimony in this proceeding?

A. To make certain that before any judgments are reached on the applications seeking authorization to construct LNG terminals at either the Weaver's Cove Fall River site or the KeySpan Providence site that the Commission recognizes that even the most minor incident of LNG release from either of those facilities or from tanker traffic while within the in-land waters of Massachusetts or Rhode Island, would present the region with an emergency that would be well beyond its capacity to handle. It is reasonable to assume that the resulting death toll would be very high, perhaps in the thousands, with an even a larger segment of the population subjected to irreversible injuries that would inflict near constant discomfort and impair the quality of life.

Q. Dr. Auerbach, before detailing the bases for your conclusions, please summarize your current professional responsibilities and your educational and professional background.

A. I have attached to my testimony, as Exhibit A, a complete curriculum vitae. As noted, I received my Medical training at Harbor-UCLA Medical Center in Torrance, California, with a medical doctorate received from Temple University Medical School and an undergraduate degree from Temple University.

Q. Are you Board certified in any areas?

A. I am Board certified in Emergency Medicine.

Q. How long have you served in your current position at Sturdy Memorial Hospital and what are your current responsibilities?

A. Since 1987, I have been responsible for oversight and management of all clinical outpatient services. I am also responsible for all aspects of the delivery of ambulatory patient care. In this role I have clinical and program responsibilities for all clinical ambulatory services the hospital provides. This includes the hospital Emergency Department, Occupational Health Services (hospital based and satellite programs), the outpatient oncology program, all outpatient specialty clinics, three multidisciplinary disease management programs, the physical therapy and cardiac/pulmonary rehabilitation programs and a school-based health center at the local 2000 student high school. In the aggregate, these areas treat in excess of 125,000 patients annually. In addition, I am responsible for the entire organization's emergency management plan, including plan development, training and education, drill scenario development and oversight as well as Incident Command System orientation for all physicians and employees.

Q. Dr. Auerbach, do you hold any other positions at Sturdy Memorial?

A. Yes. I also am Associate Medical Director and in that capacity I facilitate and support the hospital's part-time Medical Director with all medical staff and Board liaison functions and the activities of the Medical Staff Office. This includes all credentialing, risk management and quality improvement activities, medical education and the hospital's medical management program. Additionally, I have leadership responsibilities for the clinical oversight of the hospital's case management department as well as a key role in the Medical Management Committee that oversees the hospital's medical management and utilization functions.

Q. Dr. Auerbach, your description of responsibilities seems to indicate that most of your current functions are administrative in nature. Do you still practice medicine?

A. While it is true that many of my responsibilities are management and administrative in nature, I continue to be a practicing Emergency Medicine physician and provide such services to patients in the Emergency Department at Sturdy Memorial Hospital.

Q. Your curriculum vitae indicates that you have been involved with emergency preparedness activities, particularly in the post-9/11 environment. Could you please elaborate on those activities?

A. I was a founding member of the DMAT, called MA-1 and an active participant in this through its early years (mid to late 80's). I was obliged to relinquish my position on this entity during the 1990's as the ongoing weekend training requirements began to conflict with my very busy position at the hospital. Since 9/11, I have been an active participant in the Bristol County Homeland Security Task Force (an entity representing all agencies within the Bristol County region of southeastern Massachusetts, the Commonwealth of Massachusetts Anti-Terrorism Task Force (now called the Anti-Terrorism Advisory Council), the Emergency Preparedness Advisory Council formed by the Massachusetts Department of Public Health under the HRSA and CDC Cooperative Agreements (and I Chair the Southeastern Massachusetts Hospital Consortium under these agreements), as well as serving as the hospital/medical consequence representative on the Southeastern Massachusetts Homeland Security Regional Council formed by the Executive Office of Public Safety under the auspices of the Department of Homeland Security. Certainly within the context of the Bristol County and Southeastern Massachusetts Homeland Security Councils we have been actively looking at the risk assessment, hazard vulnerability and medical consequence and response related to the Weaver's Cove LNG siting.

Q. For whom are you appearing in this proceeding?

A. I am appearing on behalf of the City of Fall River and the Massachusetts Attorney General's Office in connection with the Weaver's Cove proposal to establish a liquefied natural gas (LNG) terminal in Fall River, including the impacts

stemming from the need to transit LNG supertankers up the 26 miles of inland coastal waterways in proximity to many densely populated communities.

Q. What is the basis of your belief that these communities could be impacted in the event of an accidental or deliberate breach of a LNG supertanker?

A. In my capacity as a member of the Bristol County Homeland Security Task Force, I have been extensively involved in emergency preparedness efforts that would be required in the event the Weaver's Cove terminal were approved by the Federal Energy Regulatory Commission. As part of that effort, I am fully aware about the safety and public health consequences that would flow from a release of LNG from a supertanker either as a result of an accident or deliberate attack on a LNG supertanker. Much of this understanding comes from the recently released Sandia National Laboratory Study that analyzed the consequences of a major release of LNG on water. At this point, while there is little human experience associated with a major release of LNG on water, there is no longer any dispute that a major release of LNG and the expected "pool fire" would produce thermal radiation impacts that would present unprecedented and extraordinary impacts on the emergency response and medical care resources across the entire region.

Q. Despite your conclusion that a LNG pool fire would produce "unprecedented and extraordinary impacts" on medical care facilities, can the region still handle the consequences of the event?

A. In my opinion, the answer is absolutely "no". Having reviewed the conclusions contained in the Final Environmental Impact Statement for Weaver's Cove, it is very clear to me that FERC is relying upon the premise that a pool fire event will likely never happen. Leaving aside for the moment whether FERC's expectation is legitimate, if such a pool fire ever did occur along many areas of the 26 mile nautical route up Rhode Island and Massachusetts coastal waterways, the consequences would be so far beyond the capability of existing medical resources that there is absolutely no way any conceived emergency response plan could ever capably respond to such an event. This conclusion is particularly relevant for when the LNG supertanker is in closest proximity to the City of Fall River, either at berth at the terminal or at any time the vessel is in the channel along the densely populated city environment.

Q. Please be more specific about why we cannot expect the medical care system to handle the consequences of an LNG fire-related emergency.

A. One only needs to examine the Sandia Study, which projects that a major LNG pool fire could generate thermal radiation of such intensity that it would cause 2nd degree burns to unexposed persons almost one mile away. Within a distance of between 1,500 and 2,000 feet of the fire, it can be expected that people would receive fatal burns due to the thermal radiation levels. Depending upon the location of the fire, this could produce a substantial amount of fatalities. In terms of emergency response, the handling of a large number of fatalities presents independent logistical difficulties, which I address later in my testimony. Beyond

the perimeter where the fire would produce immediate fatal burns, would be an expected high number of individuals who would receive second and third degree burns. When one examines the population densities along the proposed navigation route, in particular along areas where the federal channel is in close proximity to densely populated areas of Fall River, it is reasonable to expect that the number of injured sustaining second and third degree burns could easily be in the thousands. These numbers are simply mind-boggling to anyone experienced with and knowledgeable about the medical and emergency response community in the southeastern New England region.

Q. Please describe the current capacity of hospital beds among the available hospitals in southeastern New England that would be called upon to handle the injured in the event of a LNG catastrophe. In answering this question, please quantify the number of beds that can be assumed, on average, to be available should a region-wide emergency occur?

A. If considering the entire 13 hospital consortium in all of what is considered Southeastern Massachusetts, and including all available acute care hospitals in Rhode Island (approximately 10 that routinely offer the type of care that victims of this type of event would require), I would estimate that there are less than 4,500 beds. However, virtually every hospital in the region is running between 85% and 100% capacity, not to mention the hospitals that would be within the red and orange zones of the LNG fire event, and be, therefore, unusable. As part of our work in emergency preparedness, we have looked carefully at the issue of

surge capacity and the best we can stretch to is about 300-500 beds, across the entire region. In addition, Dr. Ken Williams, principal investigator for the Rhode Island Disaster Initiative, reported to me that one of the deliverables from this federally-funded initiative was to perform a vulnerability analysis of how the entire State of Rhode Island would handle the influx of only 500-1000 severely injured or ill persons and they determined that this number would completely incapacitate the entire system in Rhode Island, both hospital and EMS.

Clearly, the capacity to deal with the consequences of a LNG fire is grossly inadequate. Moreover, it must be emphasized that the victims of such an event will have suffered extensive burn injuries that must be treated at hospitals that have burn units. There are few hospitals in the region that have such units. There are really only two such hospitals that actually have ABA-certified burn beds. Moreover, there is little, if any capacity to handle acutely burned victims within the hospitals in Southeastern Massachusetts. The "potential" Boston area hospital beds are as follows (quotes are used around potential because the beds listed are not all specifically burn beds, but rather beds in surgical intensive care units that might be able to be converted to accommodate acute burn patients): MGH, 44, of which 4 are ABA certified Burn Beds; BIDMC, 33; B&W, 40, of which 10 are ABA certified Burn Beds; NEMC, 20; BMC, 28; Lahey, 12. RIH has 13; UMMC, 50. This means the total beds available to accommodate patients with second and third degree burns within a 60 mile radius are only 240, clearly an inadequate number for the predicted critically burned victims. And of course, this

in no way means that all these beds would be immediately available, as our institutions are constantly running their intensive care units at very close to capacity.

Q. Has southeastern New England ever experienced such a catastrophic fire event that presented such high numbers of fatalities or injuries?

A. Never, at least in my experience. Except for those who were deployed in response to terrorist attacks on the World Trade Center in New York City, most medical personnel, except possibly the military, (including myself) have little or no direct experience managing the consequences for events that involve the numbers of patients the magnitude of which we would have for an LNG disaster. While I and many of my colleagues have experience in planning for such events and a great understanding of the medical and science of the potentials, the actuality of such an event that would occur from a LNG fire would clearly parallel, or even exceed, the consequences experienced in New York City on September 11, 2001.

A good example of a major emergency response event occurred in February of 2003 when the Station Nightclub caught fire in West Warwick, Rhode Island. That fire resulted in 100 deaths and hundreds of burn victims. The Station Fire tragedy was one of the worst fires in the nation's history, yet it represents only a fraction of the consequences that would occur when compared to the potential consequences of a LNG fire.

Q. Based on the available emergency and in-patient care resources that are available within the region, what is your judgment about the regional ability to cope with an accident occasioned by the breach of LNG containment facilities? In answering that question, I ask that you to base your response on the judgments of Drs. Haven and West that a breach of containment could, at the very least, precipitate a pool fire causing anyone within a one-mile radius who does not have adequate protective clothing immediately at hand, to suffer second-degree burns in as little as thirty seconds.

A. If the fire occurred in the densely populated areas in proximity to either the LNG terminal or along the tanker navigation route, it is undisputed that the regional resources would be rapidly overwhelmed to an unimaginable degree. During the Station fire, which produced victims in the hundreds, every burn bed for about a 50 mile radius was consumed. EMS and other services responded from an equally far distance. Given the population density of the areas in consideration, a pool fire of this magnitude would result in thousands, not hundreds of victims and be totally beyond our capabilities.

Q. Dr. Auerbach, do you agree with the assessment that even the lapse of seconds in the provision of emergency services can mean the difference between life and death?

A. Clearly any delays in the provision of emergency services will have a devastating effect on an individual in proximity to a fire of the magnitude caused by a breach of an LNG supertanker or containment structure. Clothing and the components of

the human body are all too flammable. When you couple this with the relatively low percentages of total body area burned that result in death, high morbidity and long-term debilitation, seconds to minutes will assuredly mean the difference between life, life with disability and/or death (burns in the range of 20% of total body surface may carry mortality rates as high as 27-30% and 50% or greater, depending upon the study you read, have mortality rates from 33-100%.)

Q. Do you have anything that would help to describe the nature of the burns that would be sustained in a LNG fire?

A. Yes. In Exhibit B, I have provided a number of pictures that show the consequences of victims sustaining severe burns for those patients who survive. Additionally, I attach an article that appeared recently in the Wall Street Journal (Exhibit C) that describes the plight of burn victims in light of today's medical capability to treat victims. Victims of fires are very much consistent on case comparison basis.

Q. The Fire Chief of Town of Somerset indicates in his testimony that in the event of the unavailability, at the time of an incident, of access to the hospitals located in the City of Fall River, residents of Somerset would have to depend on facilities in the Providence area. Would you agree?

A. Yes, as well as possibly Brockton, Taunton and Attleboro, which will produce time-critical impacts to the injured who require immediate medical attention.

Q. What might the consequences be of the added travel time and, assuming that those in need could be transported to Providence area facilities, would those facilities have the capacity to administer the needed care in a timely fashion?

A. Given that the greatest likelihood of injury is burn-related, the added travel time could be very significant. Many of these individuals will have airway burns creating severe breathing difficulties. While our Paramedics are well-trained in airway management, burn patients with airway problems present an especially difficult situation. They frequently require a "surgical airway" (tracheotomy), which the Paramedics cannot perform. Their trachea are burned, making routine oxygenation difficult. As we all know, minutes really matter when it comes to not getting enough oxygen. On a more generic note, none of the hospitals to which these transports would occur specialize in burn care. So the short answer is they really do not have the capacity to administer the exact care the patients would require. They can provide some stabilization, but not the definitive care.

Q. Earlier in your testimony, you discussed the logistical impacts of dealing not only with burn victims, but also with fatalities. Could you please elaborate?

A. Yes. Another area that has received little focus or discussion is the fact that the thermal radiation impacts of the magnitude predicted by both the Sandia Study as well as Drs. Havens and West would leave a high number dead within the first zone demarcated by a heat flux level of 37.5 kilowatts per square meter. After the fire subsides sufficiently to allow safe access by emergency rescue personnel, the necessary protocols for handling dead bodies would also overwhelm responders

and available facilities. As an example, I would point to the recent study conducted by Richard Clarke which analyzed the consequences of a major LNG breach in the Providence River at the location of Keyspan LNG's planned terminal. Given the estimate that approximately 28,780 people live within one mile of the proposed terminal location, the Clarke Study estimated that 3,000 people would die immediately from the ensuing fire. This is an extraordinary number of dead, leaving aside the additional 10,000 people who would be injured or burned. Dealing with this number of dead is a major problem in and of itself. As the morgue and mortuary facilities in the region are limited. Depending upon the time of year, dealing with the dead can become a major problem. Obviously, in February, a site could be found to "cohort" the dead outdoors in the frigid New England climate. This would be quite a different matter if the event occurred in July. One need only examine what occurred in New York City the days following the terrorist attacks on the World Trade Center. All of the recovered bodies were decomposing, particularly given the warm seasonal trend at the time. Mortuaries had reached capacity, and there became an immediate need to generate mobile mortuaries. For example, at the lower ends of the West Side Highway, refrigerated trucks were lining the highway to accommodate the body bags.

Q. Dr. Auerbach, do you have any final thoughts or conclusions that you would like to offer to the Commission based upon your professional experience and your familiarity with the Providence-Fall River areas?

A. Yes, given my training and understanding concerning emergency response preparedness, I believe that allowing this facility to be constructed in the location selected by Weaver's Cove is an extremely bad idea – plain and simple. In this era of heightened concern about security, and the Department of Homeland Security's acknowledgement that we must do hazard vulnerability assessments and direct our attention to those areas where the hazards and vulnerabilities are the greatest, it is insane to create another point of vulnerability, particularly one that poses consequences of this magnitude. Locating an LNG terminal in some of the most densely populated areas in our country, at the end of a long water transit for the tankers is like playing Russian roulette and leaving 5 bullets in the gun. While I recognize that LNG is an excellent and clean source of energy, one that we need to continue to pursue, I would think that the federal government would do everything in its power to find an alternative location for a terminal. My conclusions are equally applicable to the Keyspan proposal in Providence.

Q. Dr. Auerbach, does this conclude your testimony?

A. Yes.

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Weaver's Cove Energy, L.L.C. and	)	Docket Nos. CP04-36-000, CP04-41-000,
	)	
Mill River Pipeline, L.L. C.	)	CP04-42-000, and CP04-43-000
	)	

DECLARATION OF WITNESS

I, Bruce S. Auerbach, declare under penalty of perjury that the statements contained in the Prepared Direct Testimony of Bruce S. Auerbach, MD, FACEP on behalf of the City of Fall River and the Attorney General of the Commonwealth of Massachusetts in this proceeding are true and correct to the best of my knowledge, information, and belief.

Executed on this 6th day of June, 2005.

Bruce Auerbach, MD, FACEP

Exhibit ___

BRUCE S. AUERBACH, MD, FACEP
8 Saddle Club Road
Lexington, MA 02420-2115
781-862-8051

CURRICULUM VITAE

NAME: Bruce Solomon Auerbach, MD, FACEP

HOME ADDRESS: 8 Saddle Club Road
Lexington, MA 02420-2115
Voice - 781-862-8051
Fax – 781-862-8943
Email – bauerbach@sturdymemorial.org

BIRTHPLACE: Philadelphia, Pennsylvania

BIRTHDATE: 17 November 1949

SPOUSE: Robin Stern Richman, MD, FACOG

CHILDREN: Three: Philip Jonathan Auerbach
Daria Claire Auerbach
Erik Richman Auerbach

EDUCATION:

Undergraduate: Temple University, Phila., PA
Bachelor of Arts in Biology 1967-1971

Graduate: University of Pennsylvania, Phila., PA
Non-degree student in Physiology 1972-1973

Medical: Université de Lille, Hôpital Régional, Lille, France
1973-1975

Temple University School of Medicine, Phila., PA
Doctor of Medicine 1975-1978

GRADUATE TRAINING:

Internship: Los Angeles County Harbor-UCLA Medical Center
Torrance, CA
Flexible 1978-1979

Residency: Los Angeles County Harbor-UCLA Medical Center
Torrance, CA

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CURRICULUM VITAE

GRADUATE TRAINING:	Emergency Medicine	1979-1981
(Cont.)	Chief Resident, Emergency Medicine	1981
LICENSURE:	State of California, G40479 (Inactive)	1979
	Commonwealth of Massachusetts, 47844	1981
SPECIALTY BOARDS:	Emergency Medicine, ABEM	1982, 1992

CURRENT POSITION:

Vice President and Chief of Emergency and Ambulatory Services
Sturdy Memorial Hospital, Attleboro, MA 1987-

Oversight and management of all clinical outpatient services. Responsible for all aspects of the delivery of ambulatory patient care. In this role I have clinical and program responsibilities for all clinical ambulatory services the hospital provides. This includes the hospital Emergency Department, Occupational Health Services (hospital based and satellite programs), the outpatient oncology program, all outpatient specialty clinics, three multidisciplinary disease management programs, the physical therapy and cardiac/pulmonary rehabilitation programs and a school-based health center at the local 2000 student high school. In the aggregate these areas treat in excess of 125,000 patients annually. In addition, I am responsible for the entire organization's emergency management plan, including plan development, training and education, drill scenario development and oversight as well as Incident Command System orientation for all physicians and employees.

Associate Medical Director
Sturdy Memorial Hospital, Attleboro, MA

Facilitate and support hospital's part-time Medical Director with all medical staff and Board liaison functions and the activities of the Medical Staff Office. This includes all credentialling, risk management and quality improvement activities, medical education and the hospital's medical management program. Additionally, I have leadership responsibilities for the clinical oversight of the hospital's case management department as well as a key role in the Medical Management Committee that oversees the hospital's medical management and utilization functions.

PAST POSITION:	Associate Director, Emergency Department	
	Newton-Wellesley Hospital	
	Newton, MA	1985-1987

Exhibit ___

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CURRICULUM VITAE

CURRENT APPOINTMENTS:

Instructor
Division of Public Health Practice
Harvard School of Public Health 2005-

Assistant Clinical Professor of Community Medicine
Tufts University School of Medicine 1985-

Instructor in Medicine, Division of Emergency Medicine
University of Massachusetts Medical School
1989-

Consultant, Annals of Emergency Medicine
1989-

Member, Board
Sturdy Memorial Associates, Inc.
A multispecialty physician group practice with 12 practice sites and 50 physicians. 1994-

Director
Board of ProMutual Group, the largest Medical Liability Insurer in Massachusetts 2002-

Member, Experience Review Panel
ProMutual Medical Professional Mutual Insurance Company
Massachusetts Medical Society Representative
1987-

Member, Emergency Medical Care Advisory Board
Department of Public Health, Commonwealth of Massachusetts 1989-

Vice Chair, Emergency Medical Care Advisory Board
Department of Public Health, Commonwealth of Massachusetts 1995-

Exhibit ___

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CURRICULUM VITAE

CURRENT APPOINTMENTS (cont):

Acting Chair, Medical Services Committee
Department of Public Health, Commonwealth of Massachusetts 1998-

Member, Ambulance Diversion Task Force
Department of Public Health, Commonwealth of Massachusetts 1999-

Member, Trauma System Development Steering Committee
Department of Public Health, Commonwealth of Massachusetts

Member, Southeastern Massachusetts Homeland Security Regional Council
Executive Office of Public Safety 2004-

Chair, Region 5 Hospital Consortium for Emergency Preparedness
Department of Public Health HRSA Cooperative Agreement 2002-

Member, Homeland Security Task Force
Bristol County Sheriff's Department 2003-

Member, Anti-Terrorism Advisory Council
US Attorney's Office 2002-

Editorial Board, PHYSICIAN'S NEWS DIGEST 1989-

Advisory Board, COVERAGE
ProMutual Medical Professional Mutual Insurance Company 1996-

Member, Helicopter Utilization Review Committee
Massachusetts Department of Public Health 1989-2002

Member, Medical Advisory Board
Commonwealth of Massachusetts Registry of Motor Vehicles 1992-

Exhibit ___

BRUCE S. AUERBACH, MD, FACEP
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CURRICULUM VITAE

Delegate, House
Massachusetts Medical Society 1996-

Trustee
Massachusetts Medical Society 1998-

President, Bristol North District Council
Massachusetts Medical Society 2002-

Exhibit ___

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CURRICULUM VITAE

HONORS/AWARDS:

Recipient of the VANGUARD AWARD for demonstrated leadership, vision and uncommon dedication to the Profession of Emergency Medicine
Awarded by Massachusetts College of Emergency Physicians 1988

Recipient of the INDOMITABLE SPIRIT AWARD for unswerving dedication and steadfastness of purpose to ensure ongoing quality Emergency Medicine
Awarded by Massachusetts College of Emergency Physicians 1993

Emergency Medicine PHYSICIAN OF THE YEAR Award presented in appreciation of outstanding service in the field of Emergency Medical Services
Awarded by Public Health Commissioner David Mulligan 1994

Massachusetts Department of Public Health Recognition Award, awarded by Public Health Commissioner Howard Koh, MD 2000

Recipient of the PINNACLE AWARD
Awarded by the Massachusetts College of Emergency Physicians 2004

PROFESSIONAL SOCIETY COMMITTEES:

Chair, Federal Government Affairs Committee
American College of Emergency Physicians
2002-

Chair, Managed Care Committee
Massachusetts Medical Society 2001-2003

Chair, Member Services Committee
Massachusetts Medical Society 2001-2004

Exhibit ___

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PROFESSIONAL SOCIETY COMMITTEES: (cont.)

Chair, Managed Care Report Survey Project Subcommittee
Massachusetts Medical Society 1995-

Member, Patient Safety Committee
American College of Emergency Physicians 2000-2002

Chair, Patient Safety Subcommittee of Federal Government Affairs Committee, American College of Emergency Physicians 2000-2002

Member, Clinical Issues Advisory Council
Massachusetts Hospital Association 1997-

Member, Committee on Strategic Planning
Massachusetts Medical Society 2002-

Member, Committee on Administration and Management
Massachusetts Medical Society 2004-

Member, Committee on Public Health
Massachusetts Medical Society 2001-

Chair, Committee on Physician Preparedness
Massachusetts Medical Society 2002-

PAST APPOINTMENTS/ ELECTED OFFICES:

President and Medical Director
Region V, Southeastern Massachusetts EMS Council 1988-2002

Examiner, American Board of Emergency Medicine 1986-1998

Councilor, Council of
American College of Emergency Physicians 1987-1993

Medical Director

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BRUCE S. AUERBACH, MD, FACEP
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CURRICULUM VITAE

PAST APPOINTMENTS/ ELECTED OFFICES: (cont.)

Massachusetts BTLS Program 1986-1995

Member, EMS Year 2000 Task Force, Commissioner of Public Health Appointment Massachusetts Department of Public Health 1992-1997

Executive Committee, Metro Boston Disaster Medical Assistance Team National Disaster Medical System 1991-1997

President Massachusetts Chapter ACEP 1988-1989

Director, Board of Directors Massachusetts Chapter ACEP 1984-1991

Member, Executive Committee of the Board Massachusetts Chapter ACEP 1985-1991

Advisor for Emergency Medicine Tufts University School of Medicine 1983-1987

Clinical Instructor in Community Medicine Tufts University School of Medicine 1982-1985

Director, Board of Southwest Suburban EMS Council, a six hospital Emergency Medical Services Consortium of the Metropolitan Boston Hospital Council 1986-1987

OTHER:

Co-Editor, Annals of Emergency Medicine Proceedings of the Clinical Advances Track of the American College of Emergency Physicians, Winter Symposium on Wound Care December, 1988; 17:1264-1369

Certification Program in Health Care Negotiation, Mediation and Conflict Resolution Harvard School of Public Health 1995

Exhibit ___

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CURRICULUM VITAE

PROFESSIONAL SOCIETIES:

American College of Emergency Physicians
1980-

Fellow, American College of Emergency Physicians
1985-

Massachusetts College of Emergency Physicians
1981-

Diplomate, American Board of Emergency Medicine 1982-

Diplomate, American Board of Medical Examiners
1978-

University Association of Emergency Medicine
1983-1988

Massachusetts Medical Society 1983-

Charles River District Medical Society
1983-1987
Bristol North District Medical Society
1987-

Club of Mainz, World Association for Emergency and Disaster Medicine 1984-

Society of Teachers in Emergency Medicine
1985-1988

National Association of EMS Physicians
1987-

American College of Physician Executives
1988-

Society for Academic Emergency Medicine
1988-

Exhibit ___

Fig. 2 - The patient on admission and after amputation of the pinnae and repair with free skin grafts.

This is the burned child AFTER having undergone some reconstructive surgery.

Fig. 3 - Same patient, at age of 9 years.

Exhibit ___

Fateful Decision

After Horrific Burn, A Wife's Choice: Is Treatment Wise?

Artificial Skin for Ted Fink Meant Pain and Risks; A 7-Month Induced Coma

'I Really Didn't Want to Look'

By Michael J. McCarthy

LANARK, Ill.—A fire in a farming accident burned Ted Fink on 93% of his body. While he lay in the hospital unconscious and near death, Rhoda Fink, his wife of 25 years, pondered whether she wanted doctors to save him.

Doctors told Mrs. Fink about a new kind of artificial skin that might help keep her husband alive. But there would be risks.

Ted Fink, before his accident

Infection could set in. Sometimes the artificial skin won't adhere all over the body, in which case Mr. Fink's chances for survival were slim. To endure the grueling pain of skin-grafting operations and other procedures, he would be placed in a drug-induced coma for several months, with the chance he wouldn't regain consciousness.

Even if he survived, he would never be the same, the doctor told Mrs. Fink. All she had seen of her husband at that point was his head. It had ballooned monstrously and his ears were nearly gone.

She decided they should try the artificial skin. After 14 months and more than 20 operations, Mr. Fink came home from the hospital. Almost everything about his physical appearance had changed. He was weak and disabled and virtually powerless over his life. Mrs. Fink was left to reflect on her decision.

"What kind of life have I subjected him to?" she wrote in her diary four years ago. "Hell on earth for the next 30 years? My life spent taking care of him? I had hoped and prayed for a better outcome."

Just a few years ago, patients with burns over more than 70% of their bodies were almost certain to die. Now, thanks to improved operating techniques and bioengineered skin, doctors have been able to cut that death rate to about 40%. Rarely in medical technology does a new product deliver such dramatic results. But for many burn victims, survival comes at a high cost of suffering. For the Finks, it would be years before they could try to judge whether saving a life was the right choice.

Rhoda Fink heard the explosion from the living room, where she sat reading the day's mail and sipping iced tea. She ran to the front door and spotted a "wall of fire," she recalls. She called 911 and asked them to send help to the Fink farm, in northwestern Illinois, about 20 miles east of the Mississippi River.

Rhoda Fink

It was a chilly, windless Saturday afternoon, Nov. 20, 1999. Mrs. Fink, a 46-year-old X-ray technician, had just returned from a day-long seminar on radiology. The Finks' corn and soybean farm had recently completed a successful harvest. Their son Peter, then 21, was at college in Ohio, and his brother Chris, then 19, had enrolled at a state university in Wisconsin to study agricultural engineering.

Ted Fink, then 45, was in his John Deere tractor moving a 1,000-gallon tank of liquid propane. Shuttling such tanks, which are used to fuel powerful ovens to dry grain for storage, was a routine job. On that day, though, the chain that held the tank onto the tractor snapped. The tank tumbled to the ground and began leaking. In a bizarre accident, the tractor apparently backfired, igniting the gas

Please Turn to Page A12, Column 1

Exhibit

A Wife's Hard Choice After Her Husban

Continued From First Page

and causing it to explode.

Two neighboring farmers saw the flames and felt the impact a mile away. They raced over and snuffed the fire engulfing Mr. Fink by throwing dirt on him. He reignited. The farmers cut away his clothes, which were glowing like embers, and found a pair of blistering hot pliers on his chest.

Paramedics and firemen plucked Mr. Fink from a field of smoking cornstalks. Someone yelled, "He's alive," Mrs. Fink recalls. She watched from a distance. "I really didn't want to look," she says. Shivering and helpless, she saw the ambulance kick up dust as it raced away.

Grim Outlook

Hours later and 90 miles away, in the burn unit at the University of Wisconsin hospital in Madison, Mrs. Fink sat at a table facing Dr. Michael Schurr, chief of the burn unit.

Dr. Schurr explained that Mr. Fink was burned on nearly every inch of his body. Only his size 14 feet, protected by a new pair of steel-toe boots, had been completely spared. Until recently, burn specialists calculated mortality odds by adding a victim's age and the percentage of body severely burned. For Mr. Fink, that meant 45 plus 93 for a probable mortality of 138%.

But the doctor said he'd had some success with a new artificial skin called Integra, approved in 1996 by the Food and Drug Administration. The bioengineered skin, which has now been used on about 13,000 patients, is made from shark cartilage and cow tendons.

Integra solves a life-threatening problem for people with large burns. The epidermis—the top layer of the skin—regenerates. But the lower portion, called the dermis, doesn't. So victims who lose large parts of their dermis require implanted skin.

Someone burned as badly as Mr. Fink typically doesn't have enough healthy skin left to "harvest" thin slices to replace burned spots. Integra, made by Integra LifeSciences Holdings Corp. of Plainsboro, N.J., would allow Dr. Schurr to immediately cover the head-to-ankle open wound Mr. Fink had become. It would give Mr. Fink precious time to regenerate skin from his few unburned spots for grafts. Integra substitutes as the lower level of skin, but doctors still must graft the victim's own epidermis on top of it.

As the doctor spoke, Mrs. Fink pictured her husband, a brawny, fifth-generation farmer, who scaled 80-foot ladders up grain silos, welded beams, repaired tractors and ran their farm almost single-handedly. At night, he tracked overseas agriculture markets on his computer, trying to figure out where prices were headed.

The doctor couldn't tell her how much her husband would ever be able to do again. But she recalls thinking, "We'll beat the system. We'll be that one-in-a-million shot."

What would Mr. Fink want? Dr. Schurr asked. She wasn't sure. She and her husband had never discussed such a predicament. Dr. Schurr recalls telling Mrs. Fink, "This is going to be long and hard, but I can try to save him." He wanted to know that her resolve wouldn't waver, that she wouldn't opt to withhold treatment later if Mr. Fink took a bad turn. The process is so

Mike McCarn/AP

Ted Fink back at work in his John Deere tractor last fall.

arduous for the victim, and so emotionally draining for the family and the medical staff, that Dr. Schurr believes stopping part-way through the treatment isn't wise. "We either try this, and give it a hero's try—or not," he told her.

There was little time for a second opinion. Mrs. Fink could agree to pull her husband from life-support equipment then and there, or gamble that the synthetic skin would give them a chance to recapture, in some form, the life they'd known. She needed to decide quickly, so they could start surgery.

"Unless you tell me there's no hope," Mrs. Fink said, "we'll keep plugging on."

That night, she wrote on the stationery in her room at the Best Western Hotel: "I pray that if Ted survives he will be accepting of all the decisions made

For the next few months, Mrs. Fink stared at the barren branches on a honey locust tree outside room #5 at the burn unit, her husband's temporary new home. Doctors placed her husband in a drug-induced coma, so he could endure repeated, painful skin grafts and treatments. He was expected to remain in the coma for months, leaving her to live with the consequences of her decision alone.

Mrs. Fink found a basement apartment near the hospital for $100 a week. Sitting with him for hours grew harder since she couldn't see his face, which was wrapped in bandages. Her days were spent calling her sons to check on the farm, greeting visitors, and scribbling into a diary that had become her only constant companion.

She helped the nurses in the burn unit decorate the Christmas tree. One day she brought photos of the farm and taped them to her husband's bed. She clipped Mr. Fink's fingernails and toenails. She packed away the Christmas tree.

In early 2000, while he was still in the coma, doctors grew concerned that Mr. Fink's right thumb wasn't healing. With the loss of a thumb, a hand loses nearly half its function, doctors say. In her diary, Mrs. Fink wrote: "I just don't know how Ted will react if they can't save his hand/hands. I'll just keep praying for miracle #2."

Doctors amputated Mr. Fink's right thumb on Jan. 31, 2000. Mrs. Fink wrote "I dream about Ted a lot. I miss talking and interacting with him very much. I can't wait for the day they wake him up and he's coherent." She added: "His right hand looks sad without the thumb."

By May, the honey locust tree had greenish-yellow blossoms. Mr. Fink was slowly improving, but now his right index finger was in trouble. That summer doctors amputated it. Mrs. Fink wrote something in her diary that she would write again and again: "I still hope he doesn't hate me for saving him."

When Mr. Fink began to emerge from his seven-month coma in July 2000, he thought it was still 1999. One of his first sentences was just three words squawked through the breathing tube in his throat: "What...will...change?"

He was now wearing skin with U.S. Patent No. 4,947,840. His body was covered with sores as his grafts struggled to replicate the seamless cocoon skin naturally forms. His nose had no tip. Just a few wisps of fine white hair curled from his scalp. His son Peter recalls, "They didn't give him a mirror for a long time

Exhibit

d's Accident

He stayed in the hospital several more months, going to physical therapy to regain strength. His case amassed a file of paperwork more than 3 feet high, and medical bills of more than $4 million. Most of that was paid for through an Illinois state health-insurance plan, after his private insurance was exhausted.

Going Home

In January 2001, Mr. Fink returned home, to the farmhouse where he had grown up. His son Chris had canceled his schooling plans to take over the farm. On his first day back, Mr. Fink asked his son to help him onto his refurbished John Deere 610 C Turbo—the same tractor he'd been on when the accident happened. "It was the first thing he needed to do when he got back," Chris says. It took $14,000 to repair the tractor following the fire.

In the months that followed, Mr. Fink went to physical-rehabilitation sessions, where he tried to re-learn such things as walking and holding a fork. Mrs. Fink quit her job to care for her husband. She drove him back and forth to rehab. She dressed him. She fed him. She brushed his teeth.

Early one morning, her husband woke her with a horrible thud. He'd fallen out of bed. Mrs. Fink shouted for their son Chris to come hoist his dad back into bed. Mr. Fink had a fat lip and was coughing up blood. It was Valentine's Day.

That night, Mrs. Fink wrote in her diary, "I'm pretty much shot here emotionally. I've spent the day crying. Crying for Ted, me, what we've lost and probably won't ever get back...I feel so empty inside. I'm giving, giving, and not getting any love back." Then she added, "But it's not about me—it's about Ted."

Some days Mr. Fink resisted going to rehabilitation. He found it exhausting, he says, and not all that helpful. Mrs. Fink persisted. "I told Ted, 'Your New Year's resolution is to brush your own teeth—I'm giving up the job.' " He finally was able to bend his elbow just enough to do it himself.

Among the hardest tasks were the baths. Mrs. Fink helped her husband into their tiny bathroom. She undressed him and cut all the bandages off his torso, legs and behind. She helped him into the shower. As he stood there, covered with sores, she rinsed him with a hand-held shower head, gently scrubbed him with soap, and rinsed him again. Then she applied lotion to his skin.

After cleaning the small device inserted in his throat in case he needed to be hooked up to a breathing machine again, she wrapped him in fresh bandages. She chose bandages in green and yellow, the colors of her husband's John Deere equip-

Courtesy Fink Family

The Fink family in late 2003, (from left) Rhoda, Peter, Ted (sitting), Chris, Deanna, and granddaughter Samantha.

Going out in public has been challenging. "Some people act like they used to act," Mr. Fink says. Others stare or turn away. "Some people flat-ass ignore you. You find out who your friends are." He adds, "I know I don't look very good."

One day last fall, Mr. Fink's first grandchild, Samantha, waddled over to the kitchen chair where he was sitting and raised her arms. The blue-eyed strawberry-blonde was born to Mr. Fink's son Chris and his wife, Deanna, in September 2003.

"Now, honey," Mr. Fink said, "you know grandpa can't pick you up." Because his arm joints are so stiff, he can't clasp the little girl in his hands. Deanna lifted the child onto her grandfather's lap. He cooed at her.

After lunch another day, Mr. Fink suddenly set down his fork, which has an extra-wide handle to make it easier to hold, and scanned under the table. He thought he'd dropped a pain pill and was worried Samantha might find it. Because he wasn't agile enough to get down on the floor, he asked his wife to look.

Some days, the entrepreneurial side of Mr. Fink resurfaces. Like many small farmers, the Finks lease much of their roughly 2,500 acres. Convinced that neighbors didn't know he was alive and looking to expand his operation, Mr. Fink began advertising in the fall of 2003 on a local radio station.

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His legs are constantly bent at the knees, because of a condition in which inflamed joints fuse over with bone. It means he can't lie flat in bed, so he began sleeping in a recliner in the living room at night. The bows of his black-frame glasses rest on ear-lobe stumps, since most of his external ear structure is gone. While riding in a car, Mr. Fink says he keeps the windows up because "when you don't have ears, the wind just howls—it's fiercely loud."

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Among the few remnants of Mrs. Fink's old life are a monthly lunch with her former hospital colleagues and her bimonthly subscription to Radiologic Technology. Between caring for Mr. Fink and keeping house, she has no plans to return to work. Mr. Fink gets disability assistance through Social Security and an Illinois state insurance program.

The Finks are Lutheran, and Mrs. Fink's lonely months in the burn unit led her to believe there are spiritual reasons her husband survived. "I saw people who were not as burned as Ted and not as old, and they would die," she says. "I don't know if you'd call it theological, but his being here just seems meant to be."

Exhibit

d's Accident

He stayed in the hospital several more months, going to physical therapy to regain strength. His case amassed a file of paperwork more than 8 feet high, and medical bills of more than $4 million. Most of that was paid for through an Illinois state health-insurance plan, after his private insurance was exhausted.

Going Home

In January 2001, Mr. Fink returned home, to the farmhouse where he had grown up. His son Chris had canceled his schooling plans to take over the farm. On his first day back, Mr. Fink asked his son to help him onto his refurbished John Deere 618 C Turbo—the same tractor he'd been on when the accident happened. "It was the first thing he needed to do when he got back," Chris says. It took $14,000 to repair the tractor following the fire.

In the months that followed, Mr. Fink went to physical-rehabilitation sessions, where he tried to re-learn such things as walking and holding a fork. Mrs. Fink quit her job to care for her husband. She drove him back and forth to rehab. She dressed him. She fed him. She brushed his teeth.

Early one morning, her husband woke her with a horrible thud. He'd fallen out of bed. Mrs. Fink shouted for their son Chris to come hoist his dad back into bed. Mr. Fink had a fat lip and was coughing up blood. It was Valentine's Day.

That night, Mrs. Fink wrote in her diary, "I'm pretty much shot here emotionally. I've spent the day crying. Crying for Ted, me, what we've lost and probably won't ever get back...I feel so empty inside. I'm giving, giving, and not getting any love back." Then she added, "But it's not about me—it's about Ted."

Some days Mr. Fink resisted going to rehabilitation. He found it exhausting, he says, and not all that helpful. Mrs. Fink persisted. "I told Ted, 'Your New Year's resolution is to brush your own teeth—I'm giving up the job.'" He finally was able to bend his elbow just enough to do it himself.

Among the hardest tasks were the baths. Mrs. Fink helped her husband into their tiny bathroom. She undressed him and cut all the bandages off his torso, legs and behind. She helped him into the shower. As he stood there, covered with sores, she rinsed him with a hand-held shower head, gently scrubbed him with soap, and rinsed him again. Then she applied lotion to his skin.

After cleaning the small device inserted in his throat in case he needed to be hooked up to a breathing machine again, she wrapped him in fresh bandages. She chose bandages in green and yellow, the colors of her husband's John Deere equip-

The Fink family in late 2003, (from left) Rhoda, Peter, Ted (sitting), Chris, Deanna, and granddaughter Samantha.

Going out in public has been challenging. "Some people act like they used to act," Mr. Fink says. Others stare or turn away. "Some people flat-ass ignore you. You find out who your friends are." He adds, "I know I don't look very good."

One day last fall, Mr. Fink's first grandchild, Samantha, waddled over to the kitchen chair where he was sitting and raised her arms. The blue-eyed strawberry-blonde was born to Mr. Fink's son Chris and his wife, Deanna, in September 2003.

"Now, honey," Mr. Fink said, "you know grandpa can't pick you up." Because his arm joints are so stiff, he can't clasp the little girl in his hands. Deanna lifted the child onto her grandfather's lap. He cooed at her.

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Exhibit ___

"You end up planning your life around his bath," she says.

The Finks' experience "is not unique, but not the usual," says John Burke, a pioneering burn surgeon and an emeritus professor of surgery at Harvard Medical School, who helped invent Integra. "A few of the survivors have considerable disability, but it turns out humans are enormously adaptable."

Of families faced with a dire situation like the Finks', Dr. Burke says: "I think people have every right to carefully weigh a decision to refuse treatment." If they accept treatment, he adds, then you have to try your hardest to save the victim.

Mr. Fink adapted slowly. The first few months after he left the hospital, he slept for hours on end. "When I came home, I had pretty much given up," he says. "I could barely walk." As he gained strength and dexterity, he eventually could shuffle with the use of a walker.

Lately, he has been able to return to some chores on the farm. He attended his older son's college graduation, and his younger son's wedding.

Mr. Fink can talk at length about soil chemistry or weather conditions, but he is a man of few words as topics turn less practical. On their first wedding anniversary after Mr. Fink got home from the hospital, he expressed his appreciation for all his wife had done by giving her a diamond ring. "I have a lot of blessings," he says.

'I'm Back'

One day, in the summer of 2003, he showed up at the desk of his local banker, dumped out the banker's pen box and deposited a fistful of Ted Fink pens. "I'm back," he said.

"I never expected he'd be in here again, physically and mentally capable, after what he'd been through," recalls the banker, Bart Ottens of Metrobank, which has continued making loans to the Fink farm.

Ted's son Chris has taken over most of the work of running the farm. Ted orders seed and equipment, contracts with buyers and handles the books. Chris does what his dad used to do: prepares the soil, plants the crops, repairs all the equipment and harvests. They usually hire a part-time helper for busy periods. At times, Ted can run the combine, which is used to harvest, by operating a joystick inside the cab with the two remaining fingers on his right hand.

One day last spring, Ted was on a tractor—the one he'd been burned on—clearing trees. Chris, on another tractor nearby, kept trying to get his father's attention. Finally, he yelled at him.

Ted recalls telling his son, "Sometimes I get engrossed in something because it helps me forget for a while how I am."

His skin these days is tough and crusty in spots. His coloration is a patchwork of bone-white, peach and blush-red.

She says she doesn't regret her decision. "Ted's glad to be here, even though he's got problems," she says. He doesn't need a breathing tube. He can feed himself. Now that he's more agile and able to wield the shower head, they've got his bath down to about an hour.

She thinks more improvement is possible, though, and would like her husband to reconsider future surgery.

"You could probably dress yourself," she told him one recent day.

"I still couldn't put my pants on," Mr. Fink retorted. Mrs. Fink dropped the subject. She says she has seen how painful skin-graft operations and recovery are. "I don't want to nag him," she says. "I'm not the one who has to go through it."

Did his wife make the right decision five years ago? "You can't condemn someone for making choices," he says. "You make them and you don't know if they're good or bad. It's done and you hope for the best. I can't begin to put myself in her shoes."

Mr. Fink says he enjoys playing with his granddaughter and doing what farming he can. Last December, he and his wife celebrated their 30th wedding anniversary. He's eager to return soon to an orchard he planted years ago, with apricot, cherry, apple and pear trees. "There's nothing nicer than going down there in the spring, when these trees bloom and give off their scent," he says.

DIRECT TESTIMONY OF DR. HARRY H. WEST

Q. Please state your name and business address.

A. Harry H. West, Shawnee Engineers, 1829 Augusta #10, Houston, Texas 77057.

Q. What is your profession?

A. I am an independent consulting chemical engineer.

Q. Do you also maintain an academic affiliation?

A. Yes. I am an Adjunct Professor of Chemical Engineering at the Process Safety Center of the Texas A&M University

Q. Please summarize your educational background.

A. I received a BS from the Bucknell University in 1965; and a PhD from the University of Oklahoma in 1969, all in Chemical Engineering.

Q. Dr. West, do you have a particular area of specialization within chemical engineering?

A. Yes, my primary specialization is in process safety, with a particular emphasis on the analysis of safeguard systems that can avoid or mitigate the consequences of a chemical release.

Q. Do you regularly do research, publish, and speak at professional symposia on those subjects?

A. Yes. A listing of my publications and symposia presentations is included in the Resume attached to this testimony as Exhibit A.

Q. Are you a registered professional engineer?

A. Yes. I am a registered professional engineer in the States of Pennsylvania and Texas.

Q. Describe your experience in LNG technology.

A. In the late 1960s, my first involvement in LNG technology was to develop a computer simulation of the LNG liquefaction process for the ChemShare Corporation, which allowed design engineers to optimize process conditions. As a member of the professional staff of University Engineers of Norman Oklahoma, I was involved in many aspects of LNG technology. In the early 1970s, I participated in the LNG safety research projects sponsored by the AGA and others, which involved LNG spills on both land and water. Experiments to evaluate the effectiveness of LNG fire control technologies were also a major project. Troubleshooting many early LNG peak shaving facilities led to numerous process developments, most notably the running film LNG vaporizer (currently used by many LNG peak-shaving facilities) and the patent on fire control of LNG tank vents.

I participated in numerous LNG safety analysis studies for proposed LNG importation terminals throughout the USA during the 1970s, including the successful projects at Cove Point, Elba Island and the Trunkline terminal in Lake Charles. For LNG liquefaction projects in the Middle East and Far East, I participated in safety analysis studies and detail design of the fire control safeguard systems.

One significant aspect of LNG safety analysis studies was the production of a document, which detailed the compliance of the proposed detail facility design to each paragraph of the NFPA 59A standard. The last such document I produced was in 2000 for the Dhabol India LNG importation terminal.

Q. What is your current focus in LNG technology?

A. I am currently updating my LNG safety text, originally prepared in the late 1970s with my partner, the late Dr. Lester Edward Brown. It is anticipated that this text will be used for a one semester academic course at the Texas A&M, Doha, Qatar campus. Notes from this text have been used in continuing education courses on LNG/LPG safety presented in the Far East for many years.

I am also involved in directing Texas A&M graduate students and visiting professors in several LNG research projects, specifically various Computational Fluid Dynamic models, design of fire control experiments, and development of updated LNG rollover mathematical models.

Q. Have you ever served as a consultant either to government standard setting agencies or to government officials working in areas bearing on LNG safety?

A. Yes. In the mid 1970's, University Engineers had a project to advise the US Coast Guard on the development of LNG regulations. As a senior consultant on this project, I visited LNG terminals in Algeria at the behest of the US Coast Guard, and subsequently co-authored the report to the Coast Guard containing recommended practices regarding LNG ship to shore transfer and dock fire fighting options.

Also in the mid 1970s , I was a member of the University Engineers technical team that provided LNG consulting services to the Federal Power Commission.

Q. For whom are you appearing in this proceeding?

A. I am appearing on behalf of a coalition of Cities in both Massachusetts and Rhode Island, each of which would be impacted directly by either the KeySpan or the Weaver's Cove proposals.

Q. When did your work for the Cities first commence?

A. I was first contacted by Garry Bliss on behalf of the Mayor of Providence, RI, in late 2004.

Q. Dr. West, when you were first contacted by representatives of the Mayor of Providence, were you told that your help was wanted in fighting the certification of the LNG proposals?

A. No, I was asked to assist the various city staff, most notably the Providence Fire Department, in evaluating the safety aspects of the Keyspan proposal.

Q. Dr. West, please summarize the conclusions that you reached following your evaluation.

A. While working with the Providence Fire Department, I became acutely aware of the deficiencies in the FERC safety analysis. During my review of the Keyspan draft environmental impact statements (DEIS), I had numerous technical discussions with Dr. Jerry Havens. My analysis of the LNG safety aspects of the Keyspan DEIS concurred with Dr Havens review. My testimony herein will focus

on several issues that complement and perhaps expand some of the concepts detailed by Dr. Havens.

Q. Was your work subsequently expanded to include the Weaver's Cove proposal?

A. It was. The analysis that follows, and the judgments I offer, apply equally to the Weaver's Cove and KeySpan proposals.

Q. You mentioned your concurrence with the views being offered by Dr. Havens in this proceeding. Please explain what you mean by that concurrence.

A. As Dr. Havens was in the process of preparing his testimony, he wanted to test his analysis and judgments in a "peer" review fashion. He asked that I undertake a critical review of his work. I did, and following that review I told Dr. Havens that I was in total agreement with the views and judgments expressed in the testimony that he is sponsoring.

Q. Dr. West, will you explain the concerns that you have regarding the failure of the FERC LNG safety analysis?

A. The issues which I will present herein are:

- Inadequacy of the thermal hazard exclusion zone analysis
- Lack of consideration of modern concepts of Process Safety
- Inadequate consequence modeling
- Potential use of high expansion foams systems to reduce the thermal hazard exclusion zone estimates for LNG terminal impoundment areas.

Q. How are the criteria for thermal radiation hazard exclusion zones inadequate?

A. Quantification of the LNG pool fire hazard exclusion zone involves calculating the distance from the fire at which thermal radiation levels are hazardous to people and equipment. NFPA59A and the DOT 49CFR193 use the same basic concept to define the thermal hazard exclusion zone (minimum separation distance) from LNG impoundment areas to the nearest edge of the LNG facility's property line or the nearest point of assembly where the thermal flux is 1,600 BTUs/Hr-Ft^2 (5 kW/m^2).

This level of thermal hazard is far too high to provide for the congressional intent in the Pipeline Safety Act of 1979 (codified as 49 CFR part 193), which was "protection of persons and property near an LNG facility from thermal radiation caused by ignition of a major spill of LNG"

Q. What is the impact on people from a thermal radiation level of 1,600 BTUs/ hr-ft^2. (5 kW/m^2)

A. A 2004 report prepared by ABSG Consulting Inc. for the FERC provides a literature review documenting the effects of thermal radiation on both people and structures. An excerpt from ABSG report table 2.6 is reproduced below to emphasize the impact of exposure time on injury level to people at the thermal flux of 1600 Btu/hr-ft^2 (5 kW/m^2).

Effects on People for 1,600 BTU/hr/ft^2 (5 kW/m^2) Thermal Radiation

Effect	Exposure Time (seconds)	Data Source
Severe pain	13	Burn injury criteria from the Federal Emergency Management Agency (FEMA, 1990)
First-degree burns	20	5 kW/m^2 for 20 seconds corresponds to a thermal dose of 100 kJ/m^2
Second-degree burns	30	5 kW/m^2 for 30 seconds corresponds to a thermal dose of 150 kJ/m^2
	40	FEMA, 1990
Third-degree burns (1% fatality)	50	50 seconds corresponds to a thermal dose of 250 kJ/m^2
72% probability of first-degree burns	40	TNO (1992) probit equation

From the above table, it is obvious that the level of 1,600 BTU/hr/ft^2 (5 kW/m^2) is only protective provided that the potentially exposed population will have both opportunity and capability to quickly take cover. It may also be protective to workers or emergency personnel who are wearing protective clothing This high thermal radiation level does not take into account sensitive populations, such as the elderly, handicapped or children. It also does not account for problems that startled people may encounter in the rush to escape to a protected

area. Further, it does not appear to take into account the extended duration that the thermal flux from an LNG fire is likely to last.

Q. Could you describe the protective clothing that could serve to protect workers or emergency personnel?

A. The protective equipment typically used by Fire Service personnel during rescue operations from burning buildings includes heat reflective and insulative clothing.

Q. Could residents in the immediate vicinity of an LNG terminal be issued similar clothing?

A. This is not a practicable solution to the problem of inadequate protection for a number of reasons. Workers and emergency personnel can be trained to don the protective clothing quickly, and correctly. Given the large number of residents living in proximity to the proposed Weaver's Cove site, the difficulties of providing adequate training would be enormous. Further, children, the elderly, and the disabled simply cannot respond as quickly and as completely as can workers and emergency personnel. Further, children grow; ensuring properly fitting protective clothing would be an administrative task of enormous complexity and certain of failure.

Q. Are there any regulations, standards or recommended practices that provide for exclusion zones or minimum separation distances with lower thermal radiation limits that better provide protection for the public.

A. Yes. There are several well known standards that recommend lower thermal radiation levels for the protection of people.

US Department of Housing and Urban Development

The Department of Housing and Urban Development (HUD) has established thermal radiation flux levels of 31.5 kW/m^2 (10,000 $Btu/hr\text{-}ft^2$) for buildings and 1.4 kW/m^2 (450 $Btu/hr\text{-}ft^2$) for people as guides in determining an "Acceptable Separation Distance" (ASD) between a fire consuming combustible liquids or gases and nearby structures and people. These HUD rules are codified in 24 CFR Part 51, Subpart C (paragraph 51.203) Safety standards. The following discussion from the preamble to the final HUD rule, 49 Fed.Reg. 5100 (February 10, 1984), helps to put the seriousness of this issue into context:

People in outdoor areas exposed to a thermal radiation level of approximately 1,500 BTU/ft^2- hr will suffer intolerable pain after 15 seconds. Longer exposure causes blistering, permanent skin damage, and even death. Since it is assumed that children and the elderly could not take refuge behind walls or run away from the thermal effect of the fire within the 15 seconds before skin blistering occurs, unprotected (outdoor) areas, such a playgrounds, parks, yards, school grounds, etc., must be placed at such a distance from potential fire locations so that the radiation flux level is well below 1500 BTU/ft^2- hr. An acceptable flux level, particularly for elderly people and children, is 450 BTU/ft^2- hr. The skin can be exposed to this degree of thermal radiation for a prolonged period of time with no serious detrimental effect. The effects at this exposure would be the same as a bad sunburn. Therefore, the standard for areas in which there will be people in exposed settings (e.g., outdoor recreation areas such as playgrounds and parks)

will not exceed 450 BTU/hr. sq. ft. Areas covered also include open space ancillary to residential structures, such as yard areas and vehicle parking areas. An excerpt from this HUD standard is contained in Exhibit B herein. Note that the HUD rules specifically mention LNG as one of the hazardous materials that is subject to the acceptable separation distance rule.

SFPE Handbook of Fire Protection Engineering

The Society of Fire Protection Engineers Handbook of Fire Protection Engineering 2nd Edition recommends a level of 800 Btu/hr-ft^2 (2.5 kW/m^2) as a public tolerance limit for exposure to radiant heat (see page 2-114).

European LNG Regulations

The European LNG rule, EN 1473:1997, defines the maximum allowable incident thermal radiation flux at the LNG property boundary as 5 kW/m^2 for urban areas. However, the European code defines a lower allowable thermal radiation level as 1.5 kW/m^2 for "critical areas". Examples of critical areas noted in EN 1473 are areas which are difficult to evacuate on short notice. Therefore, the European LNG rules require review of the areas that may be impacted by a major LNG fire To emphasize the difference between US and European LNG codes, consider the example of a stadium adjacent to the LNG facility. The NFPA thermal hazard exclusion zone, defined as "1600 Btu/hr/ft^2 (5000 W/m^2) at the nearest point located outside the owner's property line that, at the time of plant siting, is used for outdoor assembly by groups of 50 or more persons for a fire over an impounding area." The EN 1473 regulation specifically defines a stadium as a

critical area, and therefore the European standard would be 480 Btu/hr/ft^2 (1.5 kW/m^2) while the U.S. standard for this same area would be 1600 Btu/hr/ft^2 (5 kW/m^2). Thus, the US thermal exclusion zone rules are considerably less than their European counterpart.

The World Bank

In the 1988 World Bank manual, "Techniques for Assessing Industrial Hazards", the level of incident thermal radiation flux which causes no discomfort is listed as 1.6 kW/m^2. While this value is not a specific limit for site planning, it means that the site evaluation should review the adjacent areas out to this limit to see if special populations or critical facilities are impacted.

Thermal Radiation Recommendations in API 521

The American Petroleum Institute recommended practice 521 suggests permissible exposure to the thermal radiation from flares listed in the table below.

Permissible Thermal Radiation Exposure for Flares from API 521 (1997)

Thermal Hazard		Adjacent area considerations for determination of the acceptable separation distance
BTU/hr-ft^2	kW/m^2	
500	1.6	at any location where personnel are continuously exposed
1,500	4.7	areas where emergency actions lasting several minutes may be required by personnel without shielding but with appropriate clothing

It is inconceivable that the permissible exposure to the public outside the facility property line should be any less than the permissible exposure to personnel inside the plant.

Q Would you extend the consideration of a lower thermal radiation hazard limit to the LNG tanker route.

A. Yes. Two recent government sponsored reports provided estimates of the distance to the 5 kW/m^2 (1600 BTU/hr-ft^2) thermal flux level following an LNG release from an LNG tanker. The FERC revision of the ABSG report (table 4) estimates the distance to the 5 kW/m^2 thermal flux level as 5008 ft. Using the common point source approximation that incident thermal flux is proportional to the inverse square root of the target distance translates into about 1100 ft or almost 2 miles to the 1.5 kW/m^2 flux level.

The December 2004 Sandia report , titled "Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural Gas (LNG) Spill Over Water," estimates the distance to the 5 kW/m^2 thermal flux level as about 2000 meters (6560 ft) following an LNG release from an LNG tanker. Since Sandia used a zero wind speed in their analysis, the estimated thermal hazard impact distance using the DOT requirement of the largest local wind speed over 5% of the time would be expected to be an even greater distance. Nevertheless, again using the common point source approximation that incident thermal flux is proportional to the inverse square root of the target distance to the 1.5 kW/m^2 thermal flux level translates into over 21000 ft or almost 4 miles.

Q. What are your specific recommendations regarding thermal exclusion zones?

A. The clear intent of Congress to protect people from a major LNG release requires the consideration of a lower thermal hazard criteria (such as the 1.5 kW/m^2 value used by the Europeans or the 1.4 kW/m^2 value used by HUD) for areas adjacent to the facility and along the LNG tanker route which are inhabited by sensitive populations or critical facilities.

Therefore, FERC should consider the areas that may be subjected to the 1.5 kW/m^2 thermal radiation flux level following a major LNG spill, either from an LNG terminal or an LNG tanker.

Q. Can you illustrate the errors that FERC and some of the LNG industry use to justify refusing to consider the lower public thermal hazard zone.

A. Yes. Recently the NFPA 59A committee rejected a proposal by the member representing the views of the fire service to reduce the target thermal radiation flux values to be in agreement with modern fire service ideas[ ].

The reasons that the NFPA 59A committee advances in defense of this decision are preposterous. The following quotes are taken from the NFPA 59A white paper (59A-05-ROC) defending the decision to reject the thermal flux reduction proposal.

"such a level and duration are acceptable since a second degree burn is reversible if attended to promptly"

"... in a 30 second exposure a person can safely run away to a distance of 100 m at which distance the radiant intensity will be far less and thus avoid suffering a second degree burn"

Modern safety analysis would not define burn injuries as acceptable. The argument that the public can run away fast enough to avoid injury is equally ridiculous as it does not consider the elderly, children, or the handicapped.

To illustrate how preposterous the above NFPA 59A white paper statements are, consider that the same white paper noted *that "NFPA 59A Standard stipulates 5 kW/m^2 (1,600 Btu/hr ft^2) as a safe level of exposure at a property line that can be built upon next to a LNG storage facility"*

Clearly the 5 kW/m^2 (1600 BTU/hr-ft^2) thermal flux level can not be considered a "safe level of exposure".

The NFPA 59A white paper further states, *"... most regulations, worldwide, stipulate a level of 5 kW/m^2 as the acceptable level (for the purposes of facility design and location) for public exposure to thermal radiation hazards from a liquid hydrocarbon pool fire"*. The information on the HUD regulations, European LNG rules and the World Bank recommendations presented previously herein show that this statement is erroneous.

Although NFPA 59A continues to reject modern safety concepts, the FERC must employ the most current safety ideas in order to fulfill their duty to protect the public.

Q. Does FERC apply the widely accepted principles of Process Safety in it's deliberations and requirements?

A. No. The world wide process industry has embraced the process safety management concepts, such as the principles documented by the American Institute of Chemical Engineers. OSHA's Process Safety Management regulations in 29CFR 1910.119 are a prime example of this concept. However, OSHA does not have authority over LNG facilities, only because of the federal government mandate that OSHA regulation is precluded if another federal agency has safety regulations in place. Unfortunately this deference leaves outdated safety regulations, such as the DOT LNG safety regulations in 49CFR193, in full force. Other federal agencies with authority over segments of the process industry, such as the US Mineral Management Services rules over the offshore petroleum industry, have embraced process safety management concepts.

EPA, in 40 CFR68, expanded the process safety regulations to include impacts of hazardous chemicals outside the facility fence line.

Q. How would consideration of process safety management to proposed LNG facilities help accomplish the goal of public safety?

A. A safety management system that included formal hazard analysis would permit continuing technical review of the level of safety within the LNG facility.

A recent technical paper by ABSG (a FERC contractor) detailed the need for LNG facilities to be subjected to the safety management system concepts inherent in process safety. A copy of this paper is contained in the Exhibit C .

FERC contracted with IoMosaic Corporation in September 2004 to evaluate the cryogenic design review process and inspection program by which the FERC staff

reviews proposed projects and ensures the continued operational reliability and safety of each jurisdictional LNG import terminal and peak shaving facility. See FERC solicitation number FERC04C40490. The scope of this project included:

An evaluation of the engineering and design information required of an applicant to file in its application under Title18, Code of Federal Regulations Part 380.12 in Resource Report 13; and the subsequent review criteria used by the staff to determine reliable and safe operations, and the adequacy of company operating and maintenance practices;

A review of the staff's application of the design spill criteria used to establish thermal radiation and flammable vapor exclusion zones at LNG facilities

An assessment of whether there are additional safety features or plant components that should be examined during inspections and/or application reviews;

An assessment of international construction, operation, and maintenance standards and/or regulations, e.g., in Japan or Europe, that offer better protection and/or operating and maintenance measures/standards.

An evaluation of the Cryogenic Design and Inspection Manual prepared during the design review of proposed facilities and subsequently used to evaluate facility operation; including whether there are additional facets of plant operations, maintenance procedures, or procedures that should be examined.

Even though the contract deliverable report was submitted in late January 2005, FERC has never released the report. As a frequent contributor to the process

safety literature, it has been expected that IoMosaic would include process safety management recommendations in their report to FERC. The importance of this report is that it covers some of the concerns that have been raised herein.

Q. Why do you believe that FERC safety analysis uses inappropriate consequence models?

A. Dr. Havens has detailed the FERC's incorrect use of the plug flow vapor hold-up model for the evaluation of vapor dispersion exclusion zone evaluations. For the case of vapor dispersion exclusion zone evaluations for the process areas impoundment areas, FERC has opted to use the old NFPA definition rather than the previous DOT 193 *"§Sec. 193.2059* requirements. The result is that the "design LNG spill" in the FERC analysis is significantly less than the equivalent "design LNG spill" which would result from the previous DOT 193 *"§Sec. 193.2059* requirements, with the ultimate effect that the FERC vapor dispersion exclusion zone estimates are too small. The appendix to Dr Zinn's paper *presented at the recent LNG safety sessions of the American Institute of Chemical* Engineers conference details this FERC error. A copy of the Zinn detail discussion is Exhibit D.

Q. Dr. West, if the Commission were to accept your concerns and challenges, would it not have to reach the conclusion that it is not possible to certificate any LNG project?

A. Absolutely not. However, in the post 9/11 world it is prudent to insure the public against severe consequence events. This translates into locating LNG facilities at

a sufficient distance from the adjacent public to insure that catastrophic events will not compromise their safety.

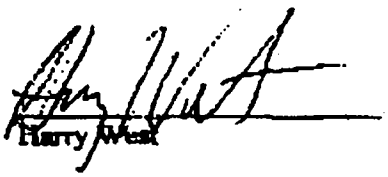
UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Weaver's Cove Energy, L.L.C. and	)	Docket Nos. CP04-36-000, CP04-41-000,
	)	
Mill River Pipeline, L.L. C.	)	CP04-42-000, and CP04-43-000
	)	

DECLARATION OF WITNESS

I, Harry West, declare under penalty of perjury that the statements contained in the Prepared Direct Testimony of Harry West on behalf of the City of Fall River and the Attorney General of the Commonwealth of Massachusetts in this proceeding are true and correct to the best of my knowledge, information, and belief.

Executed on this 3rd day of June, 2005.



Harry West

Exhibit ___

Dr. Barry L. West

Consulting Chemical Engineer

Summary Resume

SUMMARY OF EXPERIENCE

Over thirty years experience in consulting and technical project management for the oil, gas, water, chemical, and pipeline industries, with particular emphasis on process safety automation technologies.

EDUCATION

Bucknell University, B.S. Chemical Engineering
Oklahoma University, Ph.D. Chemical Engineering

EXPERIENCE

1986 - present CONSULTING CHEMICAL ENGINEER

Engineering consultancy with emphasis on the evaluation of developing safety and environmental technologies for venture capital considerations, application of Process Safety Management systems for pipeline, oil & gas facilities and forensic investigation of catastrophic chemical accidents.

ADJUNCT PROFESSOR OF CHEMICAL ENGINEERING, TEXAS A&M

Directing graduate research and conducting Process Safety short courses through the Continuing Education Center, within various Companies, and at AIChE meetings.

1980 - 1986 ENGINEERING DESIGN GROUP

President of engineering subsidiaries, Corporate Director, and Principal Engineer

Dr. West was the technical leader of the management team which transformed EDG from a small engineering consultant to an international SCADA/DCS contracting firm with billings in excess of $15MM per annum. Prior to the change to contracting, Dr. West was responsible for the full service engineering office in Houston, conducting projects in the petroleum, LNG/LPG, chemical, water, and pipeline industries. Additionally, Dr. West was responsible for establishing a Middle East operating subsidiary.

1977 - 1980 ENERGY ANALYSTS (renamed QUEST Consultants)

Co-founder, Principal Engineer, Board Chairman

EA was formed to provide consulting services for process safety automation and environmental monitoring systems. Dr. West directed the development of one of the first computer-based environmental monitoring stations. Process safety training services for petrochemical and gas facilities was also a significant part of the business. Consequence analysis and process hazards reviews were conducted for a wide variety of clients, including federally sponsored projects.

1970 - 1977 UNIVERSITY ENGINEERS

Principal Engineer

Dr. West provided engineering consulting services to the petrochemical and LNG/LPG industry. As a member of the LNG/LPG group, Dr. West was involved in over 30 peak-shaving or baseload LNG plants worldwide, ranging from conceptual design to regulatory approval to operational troubleshooting assignments. He was responsible for developing the running-film vaporizer from concept through ASME code certification to commercialization. Dr. West was the leader of a group that conducted energy and process safety audits for the process industry. Analysis of new processes for venture capital organizations was also among Dr. West's consulting assignments.

UNIVERSITY OF OKLAHOMA - Flame Dynamics Laboratory
Under a concurrent appointment as adjunct Professor of Chemical Engineering, Dr. West was involved in graduate research supervision. Dr. West taught graduate courses in chemical process control.

1969 - 1970 CHEMSHARE CORPORATION
Member of Founding Staff
Dr. West was a member of the team responsible for development of the chemical process computer simulation program, DESIGN, one of the most widely used software products of its class, demonstrated by continuing popularity today. Continued part-time association, continuing today.

1968 - 1969 UNIVERSITY OF PITTSBURGH
Assistant Professor of Chemical Engineering
In addition to research and teaching chemical process control theory, Dr. West was concurrently involved as a consultant to Westinghouse Power Systems.

1965 - 1968 UNIVERSITY OF OKLAHOMA RESEARCH INSTITUTE
Graduate Assistant
Dr. West participated in several research projects involving control systems, including a thesis on optimal feedforward-feedback control.

1964 - 1965 MOBIL OIL
Process Engineer
As a summer intern, Dr. West was involved in simulation studies of process equipment at the Paulsboro refinery.

LICENSES & SOCIETIES

Registered Professional Engineer, Pennsylvania
Registered Professional Engineer, Texas
Certified Safety Professional (retired)
American Institute of Chemical Engineers
System Safety Society
National Academy of Forensic Engineers
Instrument Society of America
Oklahoma Energy Advisory Council
Texas A&M Process Safety Research Center

PUBLICATIONS

Over eighty technical papers in chemical process control, computer simulation, SCADA/DCS, LNG technology, process safety analysis, energy efficiency and reliability.

PATENTS

One patent on LNG tank fire control system
One patent on Running film LNG vaporizer

Exhibit___

Dr. Harry H. West, P.E.
Summary of LNG/LPG Project Experience

Dr. West began his engineering career with providing process control design, process hazards analysis, risk assessments, safety systems design reviews, and site safety audits for liquefied natural gas (LNG) and liquefied petroleum gas (LPG) facilities. During the past thirty-five years, he has provided process safety engineering services for peak-shaving & baseload production facilities, receiving terminals, storage, and transportation systems.

He has participated in many LNG/LPG project teams over the past decades, both domestically and internationally. Dr. West has participated in various phases of the LNG/LPG industry, including projects outlined below;

- Project Feasibility studies
  - Process Simulation using ChemShare Design II
- Developed the Running-Film Cryogenic Vaporizer from concept to commercialization at Philadelphia Gas Works (500 MMSCFD)
- LNG Research projects
  - Tank Rollover/Vaporizer Stabilization
  - Fire Protection system design data
  - Fiberglas Cryogenic Tank Certification
  - Tanker Safety Protective Automation Systems
- Process Safety projects
  - Process Hazards Analysis / QRA
  - ESD and Fire Protection Systems
  - Production Barge/Ice-Breaker Tanker
- Investigation of LNG/LPG release incidents
- Project Safety Evaluation for Government Permit.
- LNG/LPG process safety engineering short courses on both an open enrollment basis and for individual corporations.
- Pioneer in applying the developing concepts of quantitative risk assessment (QRA) during the early 1970's to LNG/LPG regulatory requirements.
- Assisted in U. S. Coast Guard project to define LNG/LPG marine regulatory framework.

Exhibit ____

Current Texas A&M Process Safety Center LNG Projects

LNG Library

Based upon the donation of Professor C M Sliepcevich (research director of Constock Methane and director of the initial LNG technology developments in the 1950s), the library is soliciting hard to find papers and reports documenting LNG research and development.

LNG Release Source term definition

DEGADIS is only vapor dispersion model currently available which has been approved by DOT/NFPA, but does not have a source term. Problems which DEGADIS can not handle include:

- horizontal pressurized jet releases
- Long trench pools, as required for analysis of transfer line leaks, process area leaks
- GRI SOURCE code was mentioned in 80s NFPA, but abandoned when many problems surfaced. GTI's SOURCE5 code still does not have material balance and therefore can be used incorrectly.

Verification of commercial LNG consequence modeling software

DOT mentions DEGADIS and FEM3A (but FEM3A is not available yet). Also note that one can use other software "approved by administrator'.
Procedures to get OPS / DOE to approve other commercial models are being considered.
Validation against both field test data and results of several specifically well defined sample scenarios (tanker spill, tank spill, process area spill; water vs. land cases, etc)

Need to identify specific maximum credible accident design spill parameters used most often in applications to regulatory agencies and for local community out reach (consider Canada & European rules too)

Dispersion Modeling using FLUENT Computational Fluid Dynamics

With the proposed use of CFD models for LNG vapor dispersion by DOE and others, MKOPSC proposes to extend the work done with *FLUENT* on pyrophoric chemical releases to *LNG / LPG* releases. This is particularly relevant since DOE has announced their internal CFD project also using FLUENT.
MKOPSC has used FLURENT in a graduate thesis concerned with pyrophoric silane dispersion.

Pool Fire Models

Large pool Fire

- Need data on large fire columns to validate large LNG pool fire model, also determine if there is a size where air entrainment ratios become limited, hence causing smokey (less thermal radiative) fires
- Current models are based upon very small scale experimental data
- Biggest LNG spill on water was $40m^3$, but hazard analysts are extrapolating to $25{,}000m^3$ spills
- Effect of composition on LNG fire thermal radiation

Suggest controlled experiments prior to large fire tests
Design a field of orifices with gas nozzles that we can spread apart, making bigger fire,. more controllable experiment, design of experiment is underway
Later possible LNG spill fire tests may be considered.

Exhibit ____

Vapor Dispersion Mitigation
Evaluation of vapor fences, water curtains, fog nozzles and other vapor dispersion mitigation techniques.

Use of infrared and LIDAR to activate Vapor Cloud / Fire protection systems

Fire Protection
Survey of LNG fire fighting
- Peak shaving / baseload production / import terminals / truck loading stations / satellite peaking stations / marine dock issues
- Training facilities / Brigade issues

Review Effectiveness of Low, Medium and High Expansion Foam
- Under what conditions does it blow away? Does it help in larger areas or not?
- Get data for engineering fixed system design at fire school tests

Research parallel to fire training to validate design parameters for engineering design of fixed dry chemical fire fighting
- Note that all the work on establishing LNG fire fighting application rate data for dry chemicals and high expansion foam in 70s and 80s and now with new chemicals and equipment, industry needs to update application rate data.

Research to determine protection effectiveness of foamed polystyrene insulation in fire situations, including the effect of thermal radiation barriers

Similar research on ablative coating fire protection systems, including survey of current long term users.

Comparison and review of LNG regulations
Compare DOT with forthcoming NFPA 59A
Expand this comparison to include European code EN 1473, Canadian special conditions, Australian, Korean and Japanese practice.

There are many non-OPS regulated peak shaving facilities in USA that are under the OSHA PSM and NFPA rules (not DOT 193), requiring comparisons and suggested solutions to conflicts

LNG / LPG text book
Updating current text for use in two semester course for Qatar campus

Qatar LNG / LPG Fire School,
Coupled with the academic program (no fire protection school in the middle east)

LNG Water Vapor Explosion or Rapid Phase Transformation
Review current research projects and theories. Test Gaz deFrance computer model against controlled experiments

Aerosol Formation, Prediction And Laboratory Measurements
Continue current research, extending to cryogenic fluids
Larger scale tests emphasizing electrostatic ignition conditions and methods to reduce static charge potential or drop formation

Alarm Management
Continue defining alarm management techniques, particularly combining HAZOP and Alarm priority studies. Per API 14C concept, apply SAFECHART methodology to LNG unit operations

(refrigeration, vaporizer, marine transfer, etc). Then couple with Alarm priority , grouping suggestions

Vehicle Fuel
Update on status of LNG technology and safety issues in utilization as vehicle fuel

LNG SIS database
Survey to update GRI's historical failure rate database (last data in 1980s). Unit operations fault tree models.

Benchmarking LNG practice
Similar to the surveys conducted for PSM practice.

NOX control concepts for Submerged Combustion Vaporizers
Cooler bath means ammonia NOX control is not efficient. Current designs of >40 ppm NOX are not within regulatory guidelines.

Rollover Modeling
Due to European regulations suggesting Rollover models to avoid excessive (100 x normal boil-off) handling capability. Sensitivity / SIS data on LNG linear temperature probes & densitometers. Mixing efficiency models for circular and rectangular tanks. Effectiveness of bottom mixing jets and proposed vapor injection systems.

Exhibit ___

LNG/LPG
Project Experience

Baseload

North Africa
- Sonatrach
  - LNG-1
  - LNG-2
  - Camel
  - Skikda

Indonesia
- Huffco-Badak
- Mobil-Arun

Europe
- Zeebrugge

USA
- Trunkline
- CovePoint
- Savannah

Abu Dhabi
- Das Island

Taiwan
India; Dhabol
Exxon Schutte Creek

Peak-shaving

Philadelphia Gas Works
- terminal A
- terminal B

Boston Gas
Lowell Gas

Baltimore Gas & Electric

Minnegasco

Atlanta Gas Light

Texas Eastern

Iowa Public Service

Union Carbide

Owens-Corning

Conoco Dubai

Proposed Projects

Nigeria-Bonny Lynn
Canada-Artic Pilot
Trinidad-Corpus Christi (Amoco/Tesoro/NPLA)
USA-SoCalGas-3

Exhibit ___

The Department of Housing and Urban Development (HUD) rules on determining an "Acceptable Separation Distance" (ASD) between a fire consuming combustible liquids or gases and nearby structures and people

(24 CFR Part 51, Subpart C (paragraph 51.203) Safety standards.

The following standards shall be used in determining the acceptable separation distance of a proposed HUD-assisted project from a hazard:

(a) *Thermal Radiation Safety Standard.* Projects shall be located so that:

(1) The allowable thermal radiation flux level at the building shall not exceed 10,000 BTU/sq. ft. per hr.;

(2) The allowable thermal radiation flux level for outdoor, unprotected facilities or areas of congregation shall not exceed 450 BTU/sq. ft. per hour.

(b) *Blast Overpressure Safety Standard.* Projects shall be located so that the maximum allowable blast overpressure at both buildings and outdoor, unprotected facilities or areas shall not exceed 0.5 psi.

(c) If a hazardous substance constitutes both a thermal radiation and blast overpressure hazard, the ASD for each hazard shall be calculated, and the larger of the two ASDs shall be used to determine compliance with this subpart.

(d) Background information on the standards and the logarithmic thermal radiation and blast overpressure charts that provide assistance in determining acceptable separation distances are contained in appendix II to this subpart C.

[49 FR 5103, Feb. 10, 1984, as amended at 61 FR 13334, Mar. 26, 1996]

Appendix I to Subpart C of Part 51—Specific Hazardous Substances

The following is a list of specific petroleum products and chemicals defined to be hazardous substances under §51.201.

HAZARDOUS LIQUIDS Acetic Acid Acetic Anhydride Acetone Acrylonitrile Amyl Acetate Amyl Alcohol Benzene Butyl Acetate Butyl Acrylate Butyl Alcohol Carbon Bisulfide Carbon Disulfide Cellosolve Cresols Crude Oil (Petroleum) Cumene Cyclohexane No. 2 Diesel Fuel Ethyl Acetate Ethyl Acrylate Ethyl Alcohol Ethyl Benzene Ethyl Dichloride Ethyl Ether Gasoline Heptane Hexane Isobutyl Acetate Isobutyl Alcohol Isopropyl Acetate Isopropyl Alcohol Jet Fuel and Kerosene Methyl Alcohol Methyl Amyl Alcohol Methyl Cellosolve Methyl Ethyl Ketone Naptha Pentane Propylene Oxide Toluene Vinyl Acetate Xylene

HAZARDOUS GASES Acetaldehyde Butadiene Butane Ethene Ethylene Ethylene Oxide Hydrogen *Liquefied Natural Gas (LNG)* Liquefied Petroleum Gas (LPG) Propane Propylene Vinyl Chloride

Background Information Concerning the Standards

(a) Thermal Radiation:

(1) *Introduction.* Flammable products stored in above ground containers represent a definite, potential threat to human life and structures in the event of fire. The resulting fireball emits thermal radiation which is absorbed by the surroundings. Combustible structures, such as wooden houses, may be ignited by the thermal radiation being emitted. The radiation can cause severe burn, injuries and even death to exposed persons some distance away from the site of the fire.

(2) *Criteria for Acceptable Separation Distance (ASD).* Wooden buildings, window drapes and trees generally ignite spontaneously when exposed for a relatively long period of time to thermal radiation levels of approximately 10,000 Btu/hr. sq. ft. It will take 15 to 20 minutes for a building to ignite at that degree of thermal intensity. Since the reasonable response time for fire fighting units in urbanized areas is approximately five to ten minutes, a standard of 10,000 BTU/hr. sq. ft. is considered an acceptable level of thermal radiation for buildings.

People in outdoor areas exposed to a thermal radiation flux level of approximately 1,500 Btu/ft2 hr will suffer intolerable pain after 15 seconds. Longer exposure causes blistering, permanent skin damage, and even death. Since it is assumed that children and the elderly could not take refuge behind walls or run away from the thermal effect of the fire within the 15 seconds before skin blistering occurs, unprotected (outdoor) areas, such as playgrounds, parks, yards, school grounds, etc., must be placed at such a distance from potential fire locations so that the radiation flux level is well below 1500 Btu/ft2 hr. An acceptable flux level, particularly for elderly people and children, is 450 Btu/ft2 hr. The skin can be exposed to this degree of thermal radiation for 3 minutes or longer with no serious detrimental effect. The result would be the same as a bad sunburn. Therefore, the standard for areas in which there will be exposed people, e.g. outdoor recreation areas such as playgrounds and parks, is set at 450 Btu/hr. sq. ft. Areas covered also include open space ancillary to residential structures, such as yard areas and vehicle parking areas.

(3) *Acceptable Separation Distance From a Potential Fire Hazard.* This is the actual setback required for the safety of occupied buildings and their inhabitants, and people in open spaces (exposed areas) from a potential fire hazard. The specific distance required for safety from such a hazard

depends upon the nature and the volume of the substance. The Technical Guidebook entitled "Urban Development Siting With Respect to Hazardous/Commercial Industrial Facilities," which supplements this regulation, contains the technical guidance required to compute Acceptable Separation Distances (ASD) for those flammable substances most often encountered.

(b) *Blast Overpressure:*

The Acceptable Separation Distance (ASD) for people and structures from materials prone to explosion is dependent upon the resultant blast measured in pounds per square inch (psi) overpressure. It has been determined by the military and corroborated by two independent studies conducted for the Department of Housing and Urban Development that 0.5 psi is the acceptable level of blast overpressure for both buildings and occupants, because a frame structure can normally withstand that level of external exertion with no serious structural damage, and it is unlikely that human beings inside the building would normally suffer any serious injury. Using this as the safety standard for blast overpressure, nomographs have been developed from which an ASD can be determined for a given quantify of hazardous substance. These nomographs are contained in the handbook with detailed instructions on their use.

Exhibit C

(Other ABS papers are included as Exhibit C to Haven's Testimony)

Exhibit ____

The Current Status of LNG Facility Standards and Regulations

Myron L. Casada
ABS Consulting, Risk Consulting Division
Donald C. Nordin
ABS Consulting

AIChE Spring Meeting, April 2005
5th Topical Conference on Natural Gas Utilization
Atlanta April 10-14, 2005

Abstract

With the large number of proposed liquefied natural gas (LNG) facilities in the United States (and worldwide), many new technical personnel are becoming involved in applying and interpreting LNG standards and regulations. Also, opponents of the new LNG developments are questioning whether existing safety and security requirements are adequate. In this paper, we will begin with an overview of existing standards and regulations pertinent to LNG facilities (for both onshore and offshore applications). That discussion will include documents from the National Fire Protection Association, the European Committee for Standardization, the Department of Transportation, and the United States Coast Guard. For offshore facilities, it will discuss the guidelines from some of the International classification societies. The paper will outline what is addressed (and what is not addressed) by these standards. The paper will then focus on and discuss the issues with those requirements and the changes that are currently under consideration by the standards organizations and federal regulators. The paper finishes with some specific recommendations for consideration by LNG facility developers.

Introduction

A key contributor to the safety of LNG facilities is the fact that they have, over the last 40 years, been built to some of the highest standards imposed in the petrochemical industry. These standards have matured and have been improved, even as they have been proven by the test of time. However, the industry has two major challenges facing it:

- Public opposition to traditional facilities, like onshore LNG import terminals
- Uncertainty about appropriate standards and regulations for nontraditional facilities, like LNG floating or fixed offshore import terminals

For traditional facilities, industry personnel need to have detailed knowledge of the appropriate standards, not only to implement them properly, but also to decide where a specific design in a specific location might need to exceed minimum standards. Also, if the public is going to have confidence in our ability to design, construct, and operate LNG facilities in its municipality, we need to be able to speak knowledgably about codes and standards when we interact with members of the public.

For offshore LNG terminals, regardless of their design, there are no industry standards or regulations that are as prescriptive or specific as those applicable to onshore facilities. Currently, the best sources of guidance for offshore terminal developers are the guidance

Exhibit —

documents developed by the marine classification societies (e.g., the American Bureau of Shipping, Det Norske Veritas, and Lloyd's Register of Shipping). Even with those sources, offshore terminal developers face significant uncertainty as they prepare and submit applications to the regulators for approval. This regulatory uncertainty presents significant economic risk to the developers, even though they try to make what they believe are the right decisions for the long-term safety of the facility.

In this paper, we will examine each of the major standards and regulations pertinent to LNG facilities. The examination of each document will cover:

- Technical/design areas included
- Management systems requirements (if any)
- Risk-based features (if any)
- Expected or proposed changes (if any)

We will also make recommendations regarding steps that we believe facility operators should take that go beyond the requirements of current codes, standards, and regulations.

Onshore LNG Facilities

The primary standards and regulations that apply to onshore LNG facilities in the United States are:

- NFPA 59A – *Standard for the Production, Storage, and Handling of Liquefied Natural Gas*
- EN 1473 – *Installation and Equipment for Liquefied Natural Gas - Design of Onshore Installations*
- 49 CFR Part 193 – *Liquefied Natural Gas Facilities: Federal Safety Standards*
- 33 CFR Part 127 – *Waterfront Facilities Handling Liquefied Natural Gas and Liquefied Hazardous Gas*

Each of these standards and regulations is discussed below.

NFPA 59A – *Standard for the Production, Storage, and Handling of Liquefied Natural Gas.* The National Fire Protection Association (NFPA) in the United States publishes NFPA 59A. The current version was issued in 2001, and an update is currently being prepared for release this year.

Technical/design areas included

NFPA 59A includes a wide variety of LNG facility considerations, including facility layout and spacing, process equipment requirements (e.g., for storage containers, vaporization facilities, piping systems, instrumentation and electrical equipment, LNG transfer equipment, fire protection equipment). The standard includes seismic design requirements for LNG facilities.

The standard also incorporates, by reference, codes and standards developed by a number of other organizations (e.g., American Society of Mechanical Engineers, the

Exhibit ___

American Society of Civil Engineers, the American Petroleum Institute, the American Concrete Institute, and the American Society for Testing and Materials).

Management systems requirements
NFPA 59A does not require any overall safety management system; however, there are requirements in the standard for safety, security, operations, maintenance, and training activities. There are also requirements regarding the competence of designers and fabricators. These requirements should lead a developer to implement typical safety management systems like (1) written safety programs, (2) operating procedures review and approval systems, (3) inspection, test, and preventive maintenance programs, (4) formal training programs, and (5) contractor evaluation and safety management.

Risk-based features
NFPA 59A does not require risk assessment nor does it suggest that risk techniques be used to define characteristics of the facility. However, it does require that consequence analyses be used to judge the acceptability of the facility and equipment siting. For example, the standard specifies maximum radiant energy levels and flammable vapor concentrations for specific scenarios (e.g., design spills and impoundment fires). Also, in several cases, it indicates that certain requirements of the standard can be altered if deemed acceptable to the "authority having jurisdiction." Preparation of any such submittals to the authority, using a risk-based decision-making approach, could increase the likelihood that such a submittal might be approved.

Expected or proposed changes
NFPA standards must be updated or revalidated at least every 5 years. The NFPA 59A committee has already met to prepare a new version to be released in 2005. No information regarding the nature of any proposed changes has been published yet.

EN 1473 – *Installation and Equipment for Liquefied Natural Gas - Design of Onshore Installations.* The European Norm standard EN 1473 was approved in 1997, based on an earlier British standard. Like NFPA 59A, it applies to onshore LNG facilities. However, it is a much more performance-based standard than NFPA 59A, allowing many of the design decisions to be made or justified based on the risk analyses that are required by the standard.

Technical/design areas included
The standard provides requirements for all of the types of LNG-related equipment typically found in a liquefaction plant, export terminal, import terminal, and other LNG storage locations. These requirements are presented in the body of the text and in normative (i.e., mandatory) appendices (which are provided for LNG tanks, pumps, vaporizers, and pipelines). A very useful "informative" (i.e., nonmandatory) Appendix H provides a description and illustrations of the various types of LNG storage tank designs (e.g., single, double, and full containment alternatives).

Management systems requirements
Unlike NFPA 59A, this standard explicitly requires implementation of a quality management system (QMS) and a safety management system (SMS). The QMS, which is required to meet ISO 9001, must apply to the design, procurement,

Exhibit ___

construction, and operation phases of the facility. The SMS must address the information generated in the hazard assessment for the facility.

Exhibit —

Risk-based features
EN 1473 requires that a hazard assessment be performed to evaluate potential accident events. The standard allows either a probabilistic or a deterministic approach for the hazard assessment. In the probabilistic approach, events are evaluated based on their expected frequency and consequence. Events that do not meet established acceptance criteria (which are suggested by example frequency categories, consequence categories, and a risk matrix provided in informative Appendices J, K, and L, respectively) require the development of risk mitigation measures.

In a deterministic approach, the standard requires identification of "credible hazards," determination of the consequences of those hazards, and justification of the measures necessary to control the risks of each hazard.

Analysis techniques that are specifically referenced by EN 1473 for use in a hazard assessment include:

- Hazard and operability (HAZOP) analysis
- Failure modes and effects analysis
- Event tree methods
- Fault tree methods

The Center for Chemical Process Safety (Ref. 1) and the American Bureau of Shipping (Ref. 2) both provide documents that describe these techniques in some detail.

Regardless of what method is used to perform the hazard assessment, Section 4.6 of the standard also mandates that the design be subjected first to a preliminary process flow sheet review and then to a HAZOP analysis (when approved piping and instrumentation diagrams are available). The standard requires updates of the HAZOP analysis when major changes occur and that a management of change process be implemented for lesser changes.

Expected or proposed changes
This standard has not been revised since 1997; however, because of its performance-based approach, it is not likely to require updating. The authors are not aware of any impending changes.

49 CFR Part 193 – *Liquefied Natural Gas Facilities: Federal Safety Standards.* The Part 193 regulation is based in large part on NFPA 59A (the 1996 version) and as such has requirements that are very similar to that document. It was issued and is maintained by the Office of Pipeline Safety (OPS) in the Research and Special Programs Administration (RSPA) in the Department of Transportation (DOT). The regulation is the responsibility of OPS because LNG facilities in the United States are closely associated with, and often operated by, interstate pipeline companies that are already regulated by OPS.

Technical/design areas included
The regulation covers siting requirements, design, construction, equipment, operations, maintenance, personnel qualifications and training, fire protection, and security.

Exhibit ___

Management systems requirements
Like NFPA 59A, the regulation does not explicitly require a safety management system; however, it requires control of activities that are typically controlled by a safety management system. In the United States, a process facility, like an LNG facility that handles large quantities of flammable liquids or gases, would typically be covered under the Occupational Safety and Health Administration (OSHA) process safety management (PSM) standard (29 CFR 1910.119) and the Environmental Protection Agency (EPA) risk management program (RMP) rule (40 CFR 68). However, both of those regulations specifically exempt facilities that are regulated under the DOT regulations in 49 CFR Parts 193 and 195. The result of this coordination of regulatory approaches is discussed in the conclusions to this paper.

Risk-based features
Like NFPA 59A, this regulation defines basis events that require consequence analyses, but does not require more comprehensive risk-based analysis approaches.

Expected or proposed changes
DOT has recently issued a rulemaking disestablishing the RSPA (Ref. 3). The new Pipeline and Hazardous Materials Safety Administration will manage regulations for hazardous materials transportation. Various other functions of RSPA will be handled by the new Research and Innovative Technology Administration. The changes came into effect on February 20, 2005.

One of the first things on the new organization's agenda will be the petition by the City of Fall River, Massachusetts, for DOT to revise its regulations to require the establishment of new "minimum safety standards" for the location of an LNG facility. Specifically, the petition requests that DOT add requirements, including:

- A 2,500-foot distance from an LNG facility to population centers of 1,000 people (or 250 people if the people are elderly or children)
- One mile distance from areas of 5,000 population
- A ban on closure of bridges required for hospital access
- A ban on facilities in locations where safety and security zone implementation is not practical

At the time this paper was prepared there was not formal response from DOT on how it was going to address this petition. The City of Fall River also submitted a similar petition to the United States Coast Guard (Coast Guard). That petition is described later in this paper.

33 CFR Part 127 – *Waterfront Facilities Handling Liquefied Natural Gas and Liquefied Hazardous Gas.* 33 CFR Part 127 is the Coast Guard regulation that governs waterfront import and export LNG facilities or other waterfront facilities handling LNG. Its jurisdiction runs from the carrier or barge unloading arms to the last valve before the LNG tank.

Technical/design areas included
Part 127 provides much of its design requirements by referencing NFPA 59A (in particular for siting and layout, LNG storage containers, piping systems, instrumentation

Exhibit ___

and electrical, and LNG transfer equipment). Part 127 also includes other additional requirements for piping systems, hoses, piers and wharves, layout and spacing, electrical power systems, lighting systems, communications systems, warning systems, and sensing/alarm systems. Part 127 also includes a security section that only applies to waterfront LNG and liquefied hazardous gas facilities. (Since July 2004, waterfront LNG facilities must also meet the requirements of 33 CFR Subchapter H discussed below.)

Management systems requirements
Part 127 does not mandate a comprehensive safety management system; however, it specifies that the facility operator provide a number of procedures and documents similar to those that are common to most safety management systems, including:

- Operations Manual
- Emergency Manual
- Pre-transfer Inspections
- Maintenance
- Training
- Firefighting and Emergency Response

Also, there are requirements in other Coast Guard regulations that require additional safety management measures, like the requirement to report and investigate incidents resulting in release of LNG.

Risk-based features
Part 127 does not include any specific risk-based design or operational approaches; however, Part 127.017 allows an operator to provide a written request to have alternative procedures, methods, or equipment standards considered by the Coast Guard. An effective way to provide written support for such a request would be to use one of the analysis techniques defined in the Coast Guard's *Guidelines for Risk-based Decision Making*. That document (which is available on the Coast Guard's Web site) describes procedures for use of techniques such as change analysis, relative ranking, or what-if analysis for consideration of safety equivalency.

Expected or proposed changes
The City of Fall River also submitted a petition to the Coast Guard regarding suggested changes in Coast Guard regulations related to LNG facilities. The petition suggests that the Coast Guard establish thermal exclusion zones and vapor dispersion exclusion zones for LNG vessels (moored or in transit) comparable to LNG facility zones. In the *Federal Register* of November 3, 2004, the Coast Guard requested public comment on the need for such rulemaking. Public input was due to the Coast Guard by February 1, 2005. At the time this paper was written there was no feedback from the Coast Guard regarding how it was going to respond to the petition. It is not clear that the Coast Guard will find rulemaking warranted. The Coast Guard has indicated (Ref. 4) that it is considering the information available from the ABS Consulting LNG consequence methodology study for the Federal Energy Regulatory Commission (Refs. 5 and 6) and the Sandia National Laboratory report (Ref. 7) on releases from LNG carriers as it is looking for ways to improve and help ensure the safety of LNG transportation.

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Offshore LNG Facilities

The ability and responsibility to regulate offshore terminals arises from the Deepwater Port Act of 1974 (DWPA) and is being jointly managed by the Coast Guard and the Maritime Administration (MARAD). Much of the information in this paper regarding regulation of offshore terminals came from recent testimony to Congress by Captain David Scott of the Coast Guard (Ref. 4).

Deepwater Port Act

The Coast Guard's authority to regulate deepwater ports (DWPs) is defined in the DWPA, and the regulations pertaining to the licensing, design, equipment, and operation of DWPs are provided in 33 CFR Parts 148, 149, and 150. Originally pertaining only to oil, the Maritime Transportation Security Act of 2002 (MTSA) added natural gas to the DWPA and shifted responsibility for licensing DWPs for natural gas (including LNG) from the Minerals Management Service to the Secretary of Transportation. The Coast Guard and MARAD have been formally designated by DOT to process license applications submitted under the DWPA.

Coast Guard Regulations

There are no current regulations that provide LNG-specific design requirements for offshore LNG terminals. Because offshore LNG terminals represent new concepts, the Coast Guard is applying a "design basis" approach rather than mandating a series of prescriptive requirements. Under a design basis approach, each concept is evaluated on its own technical merits, using relevant engineering standards and concepts that have been approved by recognized vessel classification societies and other competent industrial and technical bodies. Many of the codes and standards listed above for land-based installations are being used by Deepwater Port Applicants. When this is done, it is very important that the different risks and issues surrounding the offshore installation be identified. The use of a structured risk-based decision-making process will facilitate the identification of these issues and risks. One aspect of the DWPA is the solicitation for comments by other agencies with an interest in the facility. It is here that many of the land-based codes and standards will be invoked, due in part because of the familiarity that other agencies have with them. Being able to identify the offshore or project-specific issues related to the installation may help streamline this review process.

Classification Society Rules

The development of offshore LNG terminals is an example of technical innovation by industry. Associated with such innovation is the need to define design approaches that ensure that an acceptable level of safety and environmental protection is achieved. Classification societies have responded to the lack of existing standards for offshore terminals by developing new rules. The American Bureau of Shipping (ABS), Det Norske Veritas, and Lloyd's Register of Shipping have all developed preliminary rules, which are available to industry and the government as they define an approval process for these terminals. This paper uses the *ABS Guide for Building and Classing Offshore LNG Terminals (ABS Guide)* as an example of what these new documents provide (Refs. 8 and 9). The other societies' rules differ in some ways, but for sake of brevity, only the *ABS Guide* will be described.

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ABS Guide for Building and Classing Offshore LNG Terminals. ABS published the first version of this guide in 2003 and has prepared several updates based on industry and government agency input.

Technical/design areas included
ABS's Guide provides criteria that cover both steel and concrete gravity-based structures, as well as floating systems. It includes design requirements for:

- Structures
- Containment Systems
- Position Mooring Systems
- Process Facilities
- Layout and Arrangements
- Hazardous Area Classification
- Process Support and Service Systems
- Electrical Systems and Installations
- Instrumentation and Control Systems
- Safety Systems

The *ABS Guide* provides both requirements for specific design features and the analytical approaches (e.g., dynamic analyses, strength analyses) that will be used to evaluate the system designs.

Management systems requirements
The *ABS Guide* does not include specific requirements for management systems.

Risk-based features
The *ABS Guide* requires that a risk assessment be performed to (1) identify significant hazards and accident scenarios that may affect the terminal and (2) consider the benefit of existing or potential risk control options. The objective of the risk assessment is to identify areas of the design that may require the implementation of risk control measures to reduce identified risk(s) to an acceptable level. To accomplish that objective, the risk assessment is required to be a systematic process that can identify situations where a combination or sequence of events could lead to undesirable consequences, such as property damage, threats to personnel safety, and environmental damage.

The risk assessment must consider, as a minimum, the following events:

- Damage to the primary structure due to extreme weather, impact/collision, dropped objects, helicopter collision, exposure to unsuitably cold temperatures, exposure to high radiant heat
- Fire and explosion
- Loss of primary liquid containment (for a duration to be determined based on an approved contingency plan)
- LNG leakage
- Release of flammable or toxic gas to the atmosphere or inside an enclosed space

Exhibit ——

- LNG containment roll over (i.e., thermodynamic instability due to LNG stratification)
- Loss of ability to offload LNG or discharge gas ashore
- Loss of any one critical component in the process system
- Loss of any single component in the station keeping/mooring system (for floating systems)
- Loss of electrical power

The risk control options (prevention and mitigation measures) deemed necessary by the risk assessment are considered part of the design basis for the terminal.

The *ABS Guide* recommends that early in the project a risk assessment plan be developed, documented, and submitted for review prior to conducting the risk assessment. During review of the plan, an agreement will be reached on the extent of the classification society's participation and/or monitoring of project-related risk studies. The society's participation in and/or monitoring of key tasks (e.g., hazard identification meetings) is considered necessary in order to establish a minimum level of confidence in the risk assessment results.

Expected or proposed changes
ABS has been active in soliciting industry and government comments on the *ABS Guide* and as offshore terminal designs are submitted for review, it is likely that the *ABS Guide* will continue to be revised.

Conclusions

From the review of the current LNG codes, standards, and regulations it is clear there are gaps in the documents we currently have available for designing and regulating LNG facilities, both onshore and offshore, in the United States. We believe these gaps exist in the following areas:

- Lack of requirements for broad safety management systems
- Limited application of risk-based tools and risk assessment
- Significant uncertainty regarding the regulatory approval process for offshore terminals

We would like to offer recommendations for consideration by organizations developing new LNG facilities that address each of these gaps.

Recommendation 1: Consider voluntary implementation of broad safety management safety systems.

EN 1473 explicitly requires the implementation of an SMS. However, the U.S. DOT regulations and NFPA 59A do not have similar requirements. Also, because of the exemption for facilities regulated under 49 CFR Part 193, the OSHA PSM and EPA RMP regulations do not apply to U.S. LNG facilities. However, we believe that effective implementation of such systems (or similar SMSs) can contribute to long-term safety of LNG facilities and should be considered by terminal developers, even though it is not required.

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Recommendation 2: **Consider using risk assessment methodologies for LNG facilities as a tool to help evaluate facility design, operations, and maintenance.**

This is also a requirement of EN 1473 and is included in the *ABS Guide* as an important design process step. In addition, it is recommended by the Society for International Gas Tanker and Terminal Operators (SIGTTO) in its document *LNG Operations in Port Areas – Recommendations for the Management of Operational Risk Attaching to Liquefied Gas Tanker and Terminal Operations in Port Areas* (Ref. 10).

Recommendation 3: **Consider working closely with the Coast Guard and MARAD as they continue to define the technical requirements for and the process under which additional offshore terminals will be approved.**

At the time this paper was written, two offshore LNG terminals have been approved. However, because the technology is changing rapidly, additional terminal designs are likely to present different problem in the licensing process. Whether the process uses the classification society guidance documents or depends solely on a Coast Guard "design basis approach," input by all stakeholders is going to be an important part of moving the regulatory development and approval process along.

Biographies

Myron L. Casada, P.E.

Mr. Casada is Vice President of Marine, Offshore, Ports and Terminals for ABS Consulting and has over 30 years of engineering and risk assessment experience. Mr. Casada has provided extensive consulting in the risk-based decision-making and risk assessment areas for government agencies, including the Coast Guard, the Defense Department, and the Nuclear Regulatory Commission. He has been involved in ABS Consulting's support to the Coast Guard in the areas of risk-based decision making, facilitating projects involving the safety of liquefied natural gas transportation in U.S. ports, security threats to hazardous materials shipping, and safety in drill rig movements.

He also has coordinated much of ABS Consulting's support to the maritime industry in meeting the IMO International Ship and Port Facility Security Code, having helped write both ABS's *Ship Security Guide* and ABS Consulting's *Port Security Guide*.

Mr. Casada holds a B.S. degree in engineering and an M.S. degree in engineering administration (with a concentration in system reliability and risk assessment), both from the University of Tennessee.

Donald C. Nordin

Mr. Nordin has 18 years of experience in the marine, offshore and fabrication arenas. As a Senior Consultant with ABS Consulting, he acts as a primary liaison with clients to develop solutions to complicated engineering problems.

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In the LNG arena Mr. Nordin has performed studies to identify the risks associated with the development of offshore LNG facilities. He has been involved with the development of offshore LNG facilities from project conception through the regulatory filing process and remains involved with these projects as they progress. He has performed the studies necessary to select an appropriate site for the development of an offshore LNG facility based on a set of project performance goals. He has performed risk analysis and design reviews of ports and marine and offshore structures associated with oil and gas production and LNG. Mr. Nordin has conducted risk assessments for a variety of marine applications, including serving as a subject matter expert and marine systems coordinator for the development of ABS's integrated tanker risk model.

Mr. Nordin holds a bachelor of science degree in marine engineering and is a Coast Guard Licensed Third Assistant Engineer for Steam and Motor vessels, unlimited horsepower.

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Biography of Speaker

Mr. Casada (pronounces name like "Canada") is currently Vice President for Marine, Offshore, Ports, and Terminals at ABSG Consulting Inc. in Houston, a risk management and engineering consulting firm affiliated with the America Bureau of Shipping.

In that role, he is responsible for structuring projects to support clients in the LNG and related industry sectors, with current efforts underway that include risk assessment, consequence analysis, marine engineering, site evaluation, seismic qualification, and regulatory compliance assistance. Mr. Casada has 30 years experience in the risk assessment and safety consulting industry. For the last 10 years he has been involved in ABS Consulting's support to the United States Coast Guard's risk-based decision-making program, including Coast Guard projects involving LNG operational plans, consequence analyses, and security assessments.

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APPENDIX

Recent Controversy Over Vapor Dispersion Exclusion Zone Estimates

The estimation of LNG vapor cloud exclusion distances in the USA LNG DOT193 regulations (49CFR193) requires modeling the hazard scenarios of LNG flowing into spill containment sumps and storage tank diked areas. Exclusion distances are demanded to meet the public safety intent of Congress.

In several recent FERC published DEIS documents, the exclusion zone calculations resulting from a spill into a vaporization area and transfer area may have been substantially underestimated due to FERCs misunderstanding of DOT 193 rules.

The pre 2000 DOT193 rules, in no uncertain terms, specified that the exclusion zone estimates for all LNG spill secondary containment areas be based upon *Vaporization results from the spill caused by an assumed rupture of a single transfer pipe (or multiple pipes designed to deliver the same flow) which has the greatest overall flow capacity, discharging at the maximum potential capacity*

The exact same spill concept is used to define the spill containment volume.

The 1998 NPRM which proposed to harmonize the DOT193 and NFPA59A language **did not propose** reducing the exclusion zone calculation requirement for the vaporization and transfer area spill containment to the NFPA59A "accidental leakage source" There was no mention of this deletion in the NPRM. Unfortunately, there was an inadvertent language error in the final DOT193 Amendment announcement in the March 2000 Federal Register., which lead to ambiguity in this specific area.

But the DOT made it absolutely clear in their NPRM announcement and the DOT193 Amendment announcement that they did intend to maintain the **current level of safety**.

In fact, FERC does point out in their DEIS documents that some confusion on the design spill for vaporizer area exists, but due to their lack of co-ordination with DOT Office of Pipeline Safety technical staff, they appear to have misrepresented DOT intention. Furthermore, Some FERC DEIS documents do not provide transfer area exclusion zone estimates as required by DOT code.

For the vaporization area spill containment, FERC has used the older NFPA59A concept of an accidental spill from an "accidental leakage source". This has been defined by FERC to be an LNG spill from the rupture of a 1" to a 3" connection. The DOT193 intent would demand the LNG spill rate from the largest pipe at full capacity. This spill rate would be the same as the 10 minute spill used to size the containment volume.

DOT has noted some other ambiguities in the March 2000 Amendment , as evidenced by the corrections to the 193.2005 section recently published on 10 March 2004 in the Federal Register.

Pertinent details of the pre 2000 DOT 193, the December 1998 NPRM and the March 2000 Amendment are contained herein.

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The pre-2000 DOT 193 code specifically stated:

"§Sec. 193.2059 Flammable vapor-gas dispersion protection.

(c) Computing dispersion distance. A minimum dispersion distance must be computed for the impounding system.

(d) Vaporization design rate. In computing dispersion distance under paragraph (c) of this section, the following applies:

(1) Vaporization results from the spill caused by an assumed rupture of a single transfer pipe (or multiple pipes that lack provisions to prevent parallel flow) which has the greatest overall flow capacity, discharging at maximum potential capacity,...."

i) The rate of vaporization is not less than the sum of flash vaporization and vaporization from boiling by heat transfer from contact surfaces during the time necessary for spill detection, instrument response, and automatic shutdown by the emergency shutdown system but, not less than 10 minutes, plus, in the case of impounding systems for LNG storage tanks with side or bottom penetrations, the time necessary for the liquid level in the tank to reach the level of the penetration or equilibrate with the liquid impounded assuming failure of the internal shutoff valve.

(ii) In determining variations in vaporization rate due to surface contact, the time necessary to wet 100 percent of the impounding floor area shall be determined by equation C-9 in the report ``Evaluation of LNG Vapor Control Methods," 1974, or an alternate model which meets the requirements of paragraphs (ii) through (iv) in Sec. 193.2057(c)(2).

(iii) After spill flow is terminated, the rate of vaporization is vaporization of the remaining spillage, if any, from boiling by heat transfer from contact surfaces that are reducing in area and temperature as a function of time.

(iv) Vapor detention space is all space provided for liquid impoundment and vapor detention outside the component served, less the volume occupied by the spilled liquid at the time the vapor escapes the vapor detention space.

(2) The boiling rate of LNG on which dispersion distance is based is determined using the weighted average value of the thermal properties of the contact surfaces in the impounding space determined from eight representative experimental tests on the materials involved. If surfaces are insulated, the insulation must be designed, installed, and maintained so that it will retain its performance characteristics under spill conditions.

(e) Planned vapor control. An LNG facility need not have a dispersion exclusion zone if the Administrator finds that compliance with paragraph (a) of this section would be impractical and the operator prepares and follows a plan for controlling LNG vapor that is found acceptable by the Administrator. The plan must include circumstances under which LNG vapor is controlled to preclude the dispersion of a flammable mixture from the LNG facility under all predictable environmental conditions that could adversely affect control. The reliability of the method of control must be demonstrated by testing or experience with LNG spills.

The 22 December 1998 NPRM contained the exact same paragraph §(d)(1) language, but proposed to eliminate the complex insulation of contact surface conditions.

Exhibit ____

"§Sec. 193.2059 Flammable vapor-gas dispersion protection.

* * * *

*(c) * * **

(2) Dispersion conditions are a combination of those which result in longer predicted downwind dispersion distances than other weather conditions to the site at least 90 percent of the time, based on U.S. Government weather data, or as an alternative where the model used gives longer distances at lower wind speeds, Atmospheric Stability (Pasquill Class) F, wind speed = 4.5 miles per hour (2.01 meters/sec) at reference height of 10 meters, relative humidity equals 50.0 percent, and atmospheric temperature = 80 deg. F(27 deg. C).

(3) The elevation for contour (receptor) output H = 0.5 meters.

(4) A surface roughness factor of 0.03 meters shall be used. higher values for the roughness factor may be used if it can be shown that the terrain both upwind and downwind of the vapor cloud has dense vegetation and that the vapor cloud height is more than ten times the height of the obstacles encountered by the vapor cloud.

*(d) * * **

(1) Vaporization results from the spill caused by an assumed rupture of a single transfer pipe (or multiple pipes designed to deliver the same flow) which has the greatest overall flow capacity, discharging at the maximum potential capacity, in accordance with the following conditions:

(i) The rate of vaporization is not less than the sum of flash vaporization and vaporization from boiling by heat transfer from contact surfaces during the time necessary for spill detection, instrument response, and automatic shutdown by the emergency shutdown system but, not less than 10 minutes plus, in case of impounding systems for LNG storage tanks with side or bottom penetration, the time necessary for the liquid level in the tank to reach a level of penetration or equilibrate with the liquid impounded. In the case of storage tanks with an internal shutoff valve, the time necessary for spill detection and response of not less than one (1) hour must be used.

* * * * *

(2) If surfaces are insulated, the insulation must be designed, installed, and maintained so that it will retain its performance characteristics under spill conditions.

Unfortunately, after the code harmonizing project of 1999/2000, the same section of the 193 DOT code was changed to read;

§193.2059 Flammable vapor-gas dispersion protection.

...(c) The design spill shall be determined in accordance with section 2-2.3.3 of ANSI/NFPA 59A. [Amdt. 193-17, 65 FR 10959, Mar. 1, 2000]

Paragraph (d) was completely dropped. This is an obvious oversight error, since only a subparagraph was intended to be deleted per the NPRM.

The NFPA59A (2001) equivalent section 2-2.3.3 referenced above specifically stated :

§2.2.3.3 The spacing of an LNG tank impoundment to the property line that can be built upon shall be such that, in the event of an LNG spill specified in 2.2.3.5, an average concentration of methane in air of 50 percent of the lower flammability limit (LFL)

Exhibit ____

does not extend beyond the property line that can be built upon, in accordance with calculations using one of the following:
..(a) ... DEGADIS..
..(b) ... FEM3A..
..(c) A model that incorporates the following:
(1) Takes into account physical factors influencing LNG vapor dispersion, including, but not limited to, gravity spreading, heat transfer, humidity, wind speed and direction, atmospheric stability, buoyancy, and surface roughness
(2) Has been validated by experimental test data appropriate for the size and conditions of the hazard to be evaluated
(3) Is acceptable to the authority having jurisdiction

The computed distances shall include calculations based on one of the following:
(1) The combination of wind speed and atmospheric stability that can occur simultaneously and result in the longest predictable downwind dispersion distance that is exceeded less than 10 percent of the time
(2) The Pasquill–Gifford atmospheric stability, Category F, with a 4.5-mph (2-m/sec) wind speed

The computed distances shall be based on the actual liquid characteristics and the maximum vapor outflow rate from the vapor containment volume (the vapor generation rate plus the displacement due to liquid inflow).
The effects of provisions for detaining vapor or otherwise mitigating flammable vapor hazards (e.g., impounding surface insulation, water curtains, or other methods) shall be permitted to be considered in the calculation where acceptable to the authority having jurisdiction.

2.2.3.5 The design spill shall be determined in accordance with Table 2.2.3.5 Design Spill
An excerpt from that table is:
For "impounding areas serving only vaporization, process and LNG transfer areas", the design spill is "the flow from any single accidental leakage source".

As an interesting sidelight, the NFPA language above, contains the word "ONLY". Hence sub impounding areas within storage tank dikes may not actually be covered by this language. Unfortunately, there is not language anywhere in either code that specifically covers the subdike issue.

Excerpts from the Amendments to DOT 193
published in the Federal Register Amdt. 193-17, 65 FR 10959, Mar. 1, 2000

... The incorporation by reference of this standard will allow the LNG industry to use the latest technology, materials, and practices while maintaining the current level of safety.

The current Federal safety standards for LNG facilities were developed as a requirement of the Pipeline Safety Act of 1979, now re-codified in 49 United States Code Section 60103. In 1979, Congress determined that the public would be better served if the US Department Of Transportation (DOT) developed its own standards for the LNG industry. Prior to July 1, 1976, no Federal standards for LNG facilities existed. The current standard, which addresses LNG facilities used in gas pipeline transportation, was issued as a Final Rule on February 11, 1980 [45 FR 9203] and now appears at 49 CFR Part 193. Between July 1, 1976, and February 11, 1980, LNG facilities were required to comply with ANSI/NFPA 59A (1972 edition) and Part 192.

A report issued on July 31, 1978, by the General Accounting Office titled "Liquefied Energy Gases" highlighted some of the safety concerns in the transportation and storage of LNG. Foremost among those were:
(1) protection of persons and property near an LNG facility from thermal radiation caused by ignition of a major spill of LNG,
(2) protection of persons and property near an LNG facility from dispersion and delayed ignition of a natural gas cloud arising from a major spill of LNG, and
(3) reduction of the potential for a catastrophic spill of LNG.

RSPA identified many deficiencies in the pre-1980 LNG standards which needed to be corrected to reduce the potential for a *major spill of LNG and provide an acceptable level of safety. Because of the difference in format and the need for regulatory* language to facilitate enforcement, a few sections of ANSI/NFPA 59A were rewritten for their adoption in Part 193.

Exhibit ____

There have been significant changes in the ANSI/NFPA 59A since 1980. The 1996 edition of the ANSI/NFPA 59A includes the latest developments in LNG facility design and safety. Many of these developments have not been incorporated into current Part 193. The format and language of the ANSI/NFPA 59A has also changed significantly, over the years, to facilitate enforcement. ANSI/NFPA 59A is revised on a regular basis, and the revision process includes input from a wide variety of experts and a broad representation of interests.

RSPA has been very active in incorporating by reference voluntary consensus standards in its pipeline safety regulations. RSPA has participated for many years on several voluntary committees that develop consensus standards, including the ANSI/NFPA 59A technical committee. The existing Part 193 references provisions of ANSI/NFPA 59A in eight different locations. Recent amendments to the LNG regulations (February 25, 1997; 62 FR 8402 and August 1, 1997; 62 FR 41311) have brought Part 193 closer to ANSI/NFPA 59A. Unlike older editions of the ANSI/NFPA 59A, text in the current standard is in a regulatory format that makes it more suitable for incorporation by reference. RSPA is adopting the 1996 version of the ANSI/NFPA 59A. When the standard is revised in the future, RSPA will incorporate by reference the revised versions, as appropriate.

RSPA published an NPRM [63 FR 70737; December 22, 1998], proposing to replace most LNG requirements for siting, design, construction, equipment, and fire protection in Part 193 by referencing the American National Standards Institute (ANSI), National Fire Protection Association (NFPA) Standard 59A (1996 edition), titled "Standards for the Production, Storage and Handling of Liquefied Natural Gas (LNG)"

Section 193.2059 - Flammable vapor-gas dispersion protection

In the NPRM we proposed to:
(1) retain minimum 10 minute spill duration for vaporization design rate;
(2) delete planned vapor control;
(3) retain 2.5% lower flammable concentration limit at the outer boundary of flammable vapor; and
(4) add one hour time duration necessary for spill detection and response for tanks with an internal shutoff valve.

AGA, NEGA, NFPA, two operators and the Iowa Utility Board each offered comments against one or more of those requirements. AGA, NEGA and one operator commented that NFPA standard 59A does not set a 10 minute spill duration limit so that operators can take advantage of technology by using controls that can provide response time in less than 10 minutes.

NEGA said that by deleting planned vapor control to mitigate the emerging vapor from a design LNG spill increases burden on the operator and denies the operator alternative credit.

The Iowa Utility Board supported the proposal to retain the 2.5% lower limit for gas concentration. NFPA said that the 5% lower flammability limit is sufficient because the model takes concentration variations into account, and our requirement is too conservative.

One operator said there is no rationale for a one hour response time for spill detection for a tank with an internal shutoff valve.

Response

(1) We agree with the commenters that with the current technology and control system operators can respond to spills in less than 10 minutes. We have revised this requirement to agree with the ANSI/NFPA 59A standard that 10 minute spill time can be reduced if the operator can demonstrate by instrument surveillance and emergency shutdown system that less than 10 minutes is needed to respond to spills.

(2) We have deleted, as we proposed in the NPRM, the planned vapor control requirement from the regulations. We do not believe, any facility would opt for this alternative. In this final rule planned vapor control requirement will still be allowed as an alternative through a waiver.

(3) We have retained the requirement for 2.5% lower flammable limit (LFL) concentration at the outer boundary of flammable vapor to provide a reasonable margin of safety. The DEGADIS model predicts only average concentration of LNG. Because vapor does not disperse uniformly, pockets of 5% LFL concentration could be adjacent to the average distance line predicted by the model. In other words, the model can under predict the actual concentration of LNG. Because many assumptions go in the formula, the distances predicted are not always accurate. Using a 2:1 safety margin was suggested by those who developed this model. On August 19, 1999, the NFPA 59A committee discussed this issue in great detail and voted to revise ANSI/NFPA 59A standard to require a 2.5% LFL in lieu of 5% LFL. Therefore, we see no need to revise the current concentration level in the regulations. In this final rule, we are allowing use of the FEM3A vapor dispersion model as an alternate to DEGADIS. The FEM3A model accounts for

additional cloud dilution which may be caused by the complex flow patterns induced by tank and dike structures. Dispersion distances are calculated in accordance with this model described in Gas Research Institute report GRI-96/0396.5, "Evaluations of Mitigation Methods for Accidental LNG Releases. Volume 5: Using FEM3A for LNG Accident Consequence Analyses."

(4) ANSI/NFPA 59A standard also requires a one hour duration for spills from tanks fitted with internal shutoff valves. We have referenced ANSI/NFPA 59A for determining design spills.

Proposed requirement on determining Vaporization design rate under 193.2059(d) has been deleted in this rule to allow operators more flexibility in computing.

Hence,
9. Section 193.2059 is amended to read as follows:
.....
§ 193.2059 Flammable vapor-gas dispersion protection.
Each LNG container and LNG transfer system must have a dispersion exclusion zone in accordance with section 2-2.3.2 of ANSI/NFPA 59A with the following exceptions:
(a) Flammable vapor-gas dispersion distances must be determined in accordance with the model described in the Gas Research Institute report GRI-89/0242, "LNG Vapor Dispersion Prediction with the DEGADIS Dense Gas Dispersion Model." Alternatively, in order to account for additional cloud dilution which may be caused by the complex flow patterns induced by tank and dike structure, dispersion *distances may be calculated in accordance with the model described in the Gas Research Institute report GRI 96/0396.5, "Evaluation of* Mitigation Methods for Accidental LNG Releases. Volume 5: Using FEM3A for LNG Accident Consequence Analyses". The use of alternate models which take into account the same physical factors and have been validated by experimental test data shall be permitted, subject to the Administrator's approval.
(b) The following dispersion parameters must be used in computing dispersion distances:
(1) Average gas concentration in air = 2.5 percent.
(2) Dispersion conditions are a combination of those which result in longer predicted downwind dispersion distances than other weather conditions at the site at least 90 percent of the time, based on figures maintained by National Weather Service of the U.S. Department of Commerce, or as an alternative where the model used gives longer distances at lower wind speeds, Atmospheric Stability (Pasquill Class) F, wind speed = 4.5 miles per hour (2.01 meters/sec) at reference height of 10 meters, relative humidity = 50.0 percent, and atmospheric temperature = average in the region.
(3) The elevation for contour (receptor) output H = 0.5 meters.
(4) A surface roughness factor of 0.03 meters shall be used. Higher values for the roughness factor may be used if it can be shown that the terrain both upwind and downwind of the vapor cloud has dense vegetation and that the vapor cloud height is more than ten times the height of the obstacles encountered by the vapor cloud.
(C) The design spill shall be determined in accordance with section 2-2.3.3 of ANSI/NFPA 59A.

To illustrate the DOT attempt to overcome recognized ambiguities resulting from the Harmonizing code effort.

Excerpts from the Federal Register: March 10, 2004 (Volume 69, Number 47) [Page 11330-11337]

Background
On March 1, 2000, we published a final rule document amending the safety regulations in 49 CFR part 193, which apply to LNG facilities used in gas pipeline transportation (65 FR 10950). That document replaced many part 193 siting, design, construction, equipment, and fire protection requirements with references to a consensus standard, NFPA 59A, "Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)" (1996 edition). Until then, part 193 referenced NFPA 59A (1996 edition) in only a few instances concerning siting, design, and fire protection.
An amendment to Sec. 193.2005, "Applicability," inadvertently implied that LNG facilities existing on March 31, 2000 (hereafter, "existing LNG facilities"), were exempt from part 193 operation, maintenance, and fire protection standards. After recognizing this ambiguity, we published a notice of proposed rulemaking (NPRM) to revise Sec. 193.2005 (68 FR 23272; May 1, 2003). In the NPRM, we also proposed to revise incorrect cross-references that resulted from the March 1, 2000, final rule to establish minimum standards for fire drills used in fire protection training, and to require that operators review their part 193 plans and procedures at least once a year. We further proposed to update all part 193 references to NFPA 59A to the 2001 edition of that standard.

Presenters Resume

Dr. Zinn (born and raised in Hope Arkansas like another famous American!) graduated with a PhD in Industrial Engineering from the University of Oklahoma. Thereafter, Dr. Zinn was a faculty member at the University of Texas. He is a registered Professional Engineer in Texas.

Dr. Zinn began his engineering career with providing process hazards analysis, risk assessments, safety systems design reviews, and site safety audits for liquefied natural gas (LNG) and liquefied petroleum gas (LPG) facilities with Energy Analysts (later renamed Quest) and then with Jones & Neuse of Austin Texas (later renamed RMT)

During the past thirty years, he has provided process safety engineering services for peaks having & baseload production facilities, receiving terminals, storage, and transportation systems, both domestically and internationally. Dr Zinn has taught LNG / LPG process safety courses worldwide.

DIRECT TESTIMONY OF DR. JERRY HAVENS

Q. Please state your name and business address.

A. Jerry Havens, President, Havens Associates, Inc., 809 Lighton Trail, Fayetteville, Arkansas, 72701.

Q. Do you also maintain an academic affiliation?

A. Yes. I hold the title of Distinguished Professor of Chemical Engineering at the University of Arkansas, where I have been on the faculty since 1970. In addition to my teaching responsibilities, I am the Director of the University's Chemical Hazards Research Center. At the Center my responsibilities include, in perhaps most direct relation to the matters at hand, the development and verification of mathematical models for prediction of atmospheric dispersion of toxic or flammable gases. Under my direction, the Center has been involved in a number of assignments of relevance to the subject matter of my testimony in this proceeding. For example, the Center has been responsible for the development and validation of the DEGADIS gas dispersion model as well as for the continuing development and validation of the FEM3A computational fluid dynamics (CFD) gas dispersion model, both of which are the only gas dispersion models currently approved for the determination of vapor cloud exclusion zones as required by the Code of Federal Regulations (49 CFR 193) and the National Fire Protection Association (NFPA) 59A which govern siting of LNG import terminals in the United States.

Q. Please summarize your educational background.

A. I received a BS from the University of Arkansas in 1961; a MS from the University of Colorado in 1962; and a PhD from the University of Oklahoma in 1969, all in Chemical Engineering. I spent an additional one-year period as a post-doctoral fellow studying fire and explosion phenomena in the Flame Dynamics Laboratory of the University of Oklahoma prior to moving to the University of Arkansas in 1970.

Q. Dr. Havens, do you have a particular area of specialization?

A. Yes, my primary specialization is in the analysis and quantification of the consequences of releases of hazardous materials into the environment, with primary emphasis on the consequences that can occur as a result of toxic and/or flammable gas releases into the atmosphere.

Q. Do you regularly do research, publish, and speak at professional symposia on those subjects?

A. Yes. A listing of my publications, research assignments and symposia presentations is included in the Resume attached to this testimony as Exhibit A.

Q. Are you a registered professional engineer?

A. Yes. I am a registered professional engineer in the State of Arkansas.

Q. For whom are you appearing in this proceeding?

A. I am appearing on behalf of a coalition of Cities in both Massachusetts and Rhode Island, each of which would be impacted directly by either the KeySpan or the Weaver's Cove proposals.

Q. When did your work for the Cities first commence?

A. I was first contacted by Eric Poulin on behalf of the Mayor of Fall River, MA, in early 2004 and by Paul Roberti on behalf of the Rhode Island Attorney General later in 2004.

Q. Dr. Havens, when you were first contacted by representatives of the Mayor of Fall River and the Rhode Island Attorney General, were you told that your help was wanted in fighting the certification of the KeySpan and Weaver's Cove proposals?

A. No, I was not. I was told that the Cities within which the projects were proposed to be located, and others along the tanker routes, were concerned about the safety of the contemplated operations and that my independent assessment of the safety implications was desired.

Q. Did you eventually reach a judgment about the safety of the proposed projects?

A. I did. I concluded that the concerns that had been expressed initially to me by Mr. Poulin and Mr. Roberti, who were considering the Weaver's Cove and KeySpan proposals, respectively, were more than well founded.

Q. Dr. Havens, please summarize the conclusions that you reached following your evaluation of the KeySpan and the Weaver's Cove proposals.

A. To begin, let me summarily describe my view that the draft environmental impact statements (DEIS) for the Weaver's Cove and KeySpan proposals, which are required by the National Environmental Policy Act (NEPA), clearly failed to address the public interest in, and requirement for, a science-based analysis of the risks to the public that operation of these facilities could entail, as follows:

First, my analysis of the DEIS's for both facilities indicated to me that the analyses presented for the determination of exclusion zones required by 49 CFR 193 to protect the public from accidental events that the Government itself has previously deemed credible involve serious errors which have the result of downplaying the hazards involved.

Second, I am very concerned that the FERC's deliberations regarding the post 9/11 heightened threat to public safety with such facilities seems to be downplayed, when considered at all. I believe that the determination of credible events, for which we must be prepared to provide for protection of public safety, should now most soberly and carefully reconsider the possibilities for catastrophic releases that could be caused by intentional, malicious acts. There is no dispute that the events that could be caused by terrorist attack have the potential for far more serious consequences than would be deemed credible to result from accidental causes. In that regard, I feel confident that if either of these projects were in existence prior to 9/11, we would be anguishing its public safety implications today.

Third, there is a gaping hole in the provisions of the Code of Federal Regulations regarding the requirements for siting LNG import facilities. While the law currently in force requires the determination of exclusion zones, basically defined as zones from which the public is excluded, for releases of LNG that are deemed credible from the land based part of the operation (the terminal would be on land at Weaver's Cove in Fall River or at Field's Point in Providence), corresponding exclusion zones are not required for releases which could occur from the LNG

carriers, either while they are at the terminal jetty or in route (loaded) thereto. There is no dispute here, either, that LNG releases that could be caused by accident or terrorist attack on an LNG carrier can have very serious consequences because, unlike the terminal where provisions for liquid spreading control are possible and indeed widely implemented, spills of LNG onto water could not be contained. Nor does there appear to be any serious dispute about the credibility of terrorist-caused rapid spills from an LNG carrier ranging to quantities of perhaps half a (single) typical ship tank, about 12,500 cubic meters or 3,000,000 gallons of LNG, onto water. Finally, there appears to be a reasonable science-based consensus that the distances from the release to which the public would be in danger could easily exceed one mile for the most likely event that would ensue – a very large fire burning on and over the LNG spill.

Finally, and perhaps most sobering, very serious questions have been raised regarding the vulnerability of LNG carriers to the damaging environment that the ship would experience as a result of the half-tank spill and ensuing fire described above. Good engineering practice as well as scientific analysis suggest that total failure of an LNG ship, so severely exposed, with eventual burning of its entire contents, is not only possible, it must be considered likely. It is important to state here also that such fires as are being considered (a pool fire following spillage onto water of one half of a single tank, or approximately 3,000,000 gallons, from an LNG carrier) would be hopelessly beyond any current capability to extinguish or even contain. But a typical LNG carrier in service today may have as many as five tanks, each containing approximately 6,000,000 gallons. Furthermore, ships

currently proposed would carry up to twice that amount, or approximately 65,000,000 gallons. However, little or no attention, much less analysis, has been focused on the implications that are suggested by the possibility of the loss and burning of an LNG ship's entire cargo.

In summary, I am extremely concerned that in today's post-9/11 world anyone would proceed to site any new, highly concentrated energy facility in an urban setting without first providing a truly convincing argument that the benefits justify the risks attendant. Although I believe that risk-benefit analyses are useful, even perhaps the only logic-based tool we have with which to consider such questions, the determination of the possible consequences of such ventures must be looked straight in the eye with no downplaying. FERC's finding in the DEIS for the terminals' siting in Fall River and Providence "that the risk to the public from accidental causes should be considered negligible", is not justified by any scientific analysis, and any suggestion that such a statement should be considered also to apply to the public threat from terrorist attack is in my opinion completely unjustified, bordering on wishful thinking. With so many threats already in our midst, with our current inability to adequately safeguard existing hazardous installations and marine transport particularly where shipments originate from countries of questionable political stability, I am at a loss to understand how any responsible company or governmental decision maker could possibly conclude that the risks to public health and safety that would be associated with either the KeySpan or the Weaver's Cove proposals would be acceptable. In my judgment, predicated solely on my expertise about and experience with LNG facilities and

associated activities, the only rational conclusion that I believe it possible to reach is that certification of either the KeySpan or the Weaver's Cove proposal would clearly be inconsistent with the public interest if that standard at all pays allegiance to sensible risk/benefit calculations.

Q. Dr. Havens, before we discuss your specific concerns, and limiting your answer to the issues pertinent to matters involving the safety of LNG, have you ever served as a consultant either to government standard setting agencies or to government officials working in areas bearing on LNG safety?

A. Yes. When, in the 1970's, interest arose about the importation into the Unites States of LNG, I began carefully studying the prediction, through the development and utilization of mathematical and physical (wind and water tunnel) models, of vapor cloud travel distances that might be associated with releases of LNG into the environment. In 1976-77, while I was on sabbatical from the University, I served as Technical Advisor to the Office of Merchant Marine Safety in U.S. Coast Guard Headquarters in Washington. During that time, I was requested by the Coast Guard to review the major research and development efforts that had been made at that time to predict the distances to which a flammable vapor cloud might threaten public safety following the rapid spillage of 25,000 cubic meters of LNG onto water. At that time there were perhaps a half-dozen published studies that purported to answer that question, but there was very wide disagreement - the predicted flammable cloud distances for such a spill on water ranged from less than 1 mile to more than 50 miles. I prepared a report for the U.S. Coast Guard entitled "Predictability of LNG Vapor Dispersion from

Catastrophic Spills onto Water: An Assessment." That report, which I attach hereto as Exhibit B, helped to narrow the range of uncertainty in the calculations that had been made and identified for the first time the uncertainties that remained in such calculation procedures. My report was widely distributed worldwide and served, in part I believe, as the basis for Congressional authorization of $40,000,000 to initiate an LNG safety research program directed principally at the determination of consequences (fire and vapor dispersion) of major LNG spills on water. Following the preparation of that report and my return to the University of Arkansas, the University, with me serving as Principal Investigator, was contracted by the Coast Guard to develop the DEGADIS model, which is, as I have indicated, designed to predict the dispersion of denser than air gases (including LNG vapor). Since that time, I have been privileged to have had an important role in the development of the current regulatory requirements for determining vapor cloud exclusion zones to support requests to FERC and to DOE for LNG terminal siting. Both of the computer models currently required by 49 CFR 193 for calculating vapor cloud exclusion distances (DEGADIS and FEM3A) were the result of developments by my Associates and me at the University of Arkansas. The DEGADIS model was developed at the University of Arkansas, whereas the FEM3A model, originally developed by the Lawrence Livermore Laboratory in the federally sponsored research program referred to above, was selected following a comprehensive review by the Chemical Hazards Research Center of the computational fluid dynamics models then available. The FEM3A model was then subjected to a comprehensive experimental program to

validate the model for application to LNG vapor dispersion prediction in the presence of obstacles and terrain features that can importantly affect dispersion of an LNG cloud, and was modified as necessary for that specific purpose. The evaluation and further development of the FEM3A model, as well as of a broader class of computational fluid dynamic (CFD) models for application to several important Homeland Security issues, including LNG, continues today. I have also followed closely and have been involved in, if less directly, the development of the methods required by 49 CFR 193 for determining pool fire radiation exclusion zones.

Beginning in the mid-1980s I have been invited on several occasions to speak to representatives of the Office of Pipeline Safety (OPS) of the Department of Transportation (the OPS has promulgated the regulations pertaining to LNG terminal siting, 49 CFR 193) as well as representatives of the U.S. Coast Guard, the latter regarding not only LNG vapor dispersion issues, but many other issues that have become increasingly important associated with atmospheric dispersion of denser than air hazardous fuel and chemical gases. I have been requested on a number of occasions to assist the Government (Departments of Transportation, Defense, Energy, and the Occupation Health and Safety Administration) by presenting my views about the state of the art in dense gas dispersion modeling. It was during this period that I developed an association with Mr. Walt Dennis, now deceased, the official at the Department of Transportation who was then assigned the responsibility for the formulation of the parts of the Federal Regulation 49 CFR 193 that enacted (for the first time, to my knowledge)

requirements for the determination of vapor cloud and fire radiation exclusion zones to protect the public from events that could endanger people beyond an LNG terminal's boundaries. In that capacity, I assisted the Coast Guard and DOT OPS in their consideration of, and eventual adoption of, the DEGADIS and FEM3A models – DEGADIS for incorporation into the National Response Center Computer Center in Washington, and DEGADIS and FEM3A as approved models for determining vapor cloud exclusion zones as required by 49 CFR 193. In that regard, I have also been invited to speak with and assist the National Fire Protection Association in its development of LNG safety standards – especially with regard to the NFPA's incorporation in the applicable safety standard (NFPA 59A) of the requirements for usage of the DEGADIS and FEM3A models to determine vapor cloud exclusion zones.

Q. Have you been associated with any other research efforts the subjects of which are of relevance to this proceeding?

A. I have continued active research in atmospheric dispersion in general, and LNG vapor dispersion in particular, to the present day. Following the development of DEGADIS, my laboratory (the Chemical Hazards Research Center) at the University of Arkansas has been instrumental in the validation/verification, as I stated earlier, of the FEM3A model for LNG vapor dispersion prediction – this validation/verification program, applied to the FEM3A model, is to my knowledge the first such effort to provide verification of a mathematical model based on subjecting the model to comparison with carefully designed controlled experiments conducted in a wind tunnel which was purpose-designed for the task.

The Ultra-Low-Speed-Environmental wind tunnel in the Chemical Hazards Research Center is today, I believe, the largest operating wind tunnel of its kind in the world, and it continues to be used to evaluate and improve mathematical models for making a wide range of atmospheric dispersion predictions relating to atmospheric release of hazardous materials. The CHRC has actively coordinated our research efforts with several agencies of the Government, including the Department of Energy and the Environmental Protection Agency. The CHRC is currently under contract with the Gas Technology Institute and the Department of Energy National Energy Technology Laboratory in a continuation of those efforts. As a result of these efforts to provide tools that are applicable to realistic vapor dispersion scenario description, the FEM3A model is now authorized in 49 CFR 193 for use as an alternative to the DEGADIS model (which is limited to dispersion over flat terrain) for determining the effects upon dispersion of LNG vapor of plant structures (dikes, tanks, etc.) and/or significant terrain features. Perhaps of equal importance to the proceedings at hand, the FEM3A model is the first and, currently, the only model approved by 49 CFR 193 that can realistically predict the vapor cloud exclusion zones resulting from vapor cloud overflow of impoundment systems designed to contain (liquid) LNG spills.

I have also been a consultant as well as a principal investigator at the University under contract with the Department of Energy's major hazardous materials field test facility at the Nevada Test Site (NTS). The Liquefied Gaseous Fuels Spills Test Facility (LGFSTF) was constructed at the NTS during, and as a result of the $40 M research program that began in the late seventies that I referred to above. I

have been under contract either privately or as an agent of the University more or less continuously in that regard since the facility was constructed in the early 1980's. The facility is now operated as the "Nonproliferation Test and Evaluation Complex (NPTEC)" by the National Nuclear Security Administration (NNSA), and it is expected to become a cornerstone part of research efforts directed to a large number of increasingly important Homeland Security issues. I am presently principal investigator at the University on a contract with DOE-NNSA to provide scientific and technical advice and assistance regarding projects under consideration at the NPTEC.

I have been a general consultant to government and industry on these matters for thirty years, and I have been involved almost on a daily basis in research designed to measure and understand the consequences of the dispersion of dense gases or vapors, including LNG vapors, from spills on land, onto water, or released directly to the atmosphere.

In December, 1999, I was requested to provide expert opinion to the Office of Special Counsel John Danforth on matters relating to the destruction by fire of the Branch Davidian Complex near Waco, Texas, on April 19, 1993. I had two assignments: to determine whether the tear gases placed in the Complex prior to the fire either caused or contributed importantly to the catastrophic fire that followed; and to explain and determine the source of the explosion, or "fireball", that occurred in the latter phases of the fire. I believe the report which I prepared for Senator Danforth is relevant to the matters under consideration here, for two reasons. First, the determination of the importance to the fire of the tear gas that

was inserted into the building involved a complex analysis of the gas dispersion throughout the building, and I believe my analysis of that complex dispersion process contributed importantly to the resolution of many of the questions that had been raised about the tragic event. Secondly, the analysis of the "fireball" required application of my knowledge of fire and explosion phenomena which are also pertinent to the matters at hand, and I believe, here too, that my identification of that event as being the result of a boiling liquid, expanding vapor, explosion, or BLEVE, caused by the rupture of an LPG tank that had been used for cooking contributed importantly to the resolution of questions that had been raised in this regard.

Q. Dr. Havens, to provide a context for your conclusions, would you please describe why LNG, if released into the environment, gives rise to credible safety concerns?

A. The primary hazards (to the public) that could result from the errant release of LNG are:

- Fire hazard from Liquid Pool Fires
- Fire hazard from Vapor Cloud Fires
- Vapor Cloud Explosion hazard

There are three other hazards that require identification and consideration, although it is noted here that they are of less concern than the fire and explosion hazards, primarily because they would not be expected to pose off-site hazards, that is, they would not be expected normally to affect the public.

- Toxicity hazard
- Cryogenic ("cold" burn) hazard

o Rapid phase transition (flameless explosion) hazard

I will first briefly describe these last three hazards, in order to identify and prioritize any associated concerns for public safety, before considering the primary hazards associated with liquid pool fires and vapor cloud fires and explosions.

Toxicity Hazard - LNG is natural gas that has been cooled to its condensation temperature (its boiling point temperature, normally at approximately atmospheric pressure). The composition of natural gas varies widely depending upon the source of the gas, but it normally contains as its principal component methane. Other heavier hydrocarbons such as ethane, propane, butane, etc., normally compose the remainder. Before LNG can be vaporized and fed into the natural gas pipeline system, it must meet requirements specified for its heating value (energy content), which depends importantly on the content of the heavier hydrocarbons noted above. Depending upon the composition of the LNG and requirements that the vaporized LNG be compatible with pipeline gas, LNG rich in heavier hydrocarbons, referred to in the industry as "hot gas", may require removal of some of the heavier components. For purposes of assessing the hazards of LNG, it is reasonable to consider its toxicity to be that of methane, the principal component, with some modification to allow for consideration of the toxicity of the heavier components which may be present. Since methane is not a toxic material, and normally poses a hazard only if breathed in sufficient quantity to displace necessary quantities of oxygen, methane does not pose a toxicity hazard to the public since the public would not be expected to be exposed to high

o Rapid phase transition (flameless explosion) hazard

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enough concentrations to result in severe displacement of oxygen. Similar considerations apply for the heavier components in "hot LNG", with the result that the toxicity of LNG (that is, the toxicity of LNG vapors) is not considered to be an important concern for public safety, particularly in relation to the more important potential for public danger from the combustion (burning) of the LNG vapor.

Cryogenic ("Cold Burn") Hazard - LNG, as pure methane, has a temperature of approximately -260 F. It is a cryogenic liquid, and exposure of living tissue to such temperatures can cause immediate severe injury. The author is aware of at least one death which resulted from being deluged with LNG because of an equipment failure (ruptured valve). However, injury to the public is not expected to occur by exposure to such extreme temperatures because the region near a release of LNG where contact with the gas could cause such "cold" burns would not be expected to extend to distances where the public could be exposed.

Rapid Phase Transition (Flameless Explosion) Hazard - If a small volume of LNG is rapidly poured into water, the LNG can be heated by the water to temperatures greater than its normal boiling point while remaining in the liquid state. The (liquid) LNG is then said to be *superheated*. If several degrees of superheat are achieved, the evaporation (boiling) process which follows can be essentially instantaneous, with the result that significant pressure increases (overpressures) can result. Such overpressures can cause damage similar to the overpressures caused by more *conventional explosions* which are normally associated with rapid

combustion of a chemical or fuel. The rapid phase transition (RPT) which can occur if LNG is added to water was first observed, unexpectedly, in a laboratory experiment performed in the 1960's at the U. S. Bureau of Mines. Subsequent research into the phenomenon has been performed by several organizations, most prominently by inhouse industry research programs. All of the work of which I am aware is relatively small scale, but there have been calls for additional research to better determine the scaling characteristics of rapid phase transitions. That said, the damaging overpressures that could occur from rapid phase transitions would be expected to be local, much as would be the potential for exposure to cryogenic temperatures discussed above, and such overpressures would not be expected to extend to distances which could endanger the public. However, it should be noted here that there is continuing interest in, and a need for, further research to study the scaling characteristics of RPT's. Although dangers to the public are not expected to result directly from RPT overpressures, their importance in the public safety context lies in the potential for RPT's to cause secondary damage which could lead to cascading failures and further releases of LNG.

I will turn now to the primary hazards to the public – fire and explosion hazards.

Fire Hazard - There are two ways that very large fires (that could endanger the public) can result from a major LNG spill – pool fires and vapor cloud fires.

Pool Fires - Spilled LNG will evaporate rapidly due to high rates of heat transfer from the warm surroundings to the cold LNG. The vapor evolving from the liquid pool will mix with air to form a gas-air mixture which can be ignited in the

concentration range of approximately 5% to 15% LNG vapor (the concentration range that is flammable for methane-air mixtures). Such mixtures of LNG vapor and air will inevitably form when LNG is spilled, and if an ignition source such as an open flame or spark are present at a location where the gas mixture is within the flammability range, as would be highly likely to accompany the violent circumstances (as in a collision or terrorist attack) that would cause a major release, a large pool fire will result. In this instance the fire will immediately burn through the gas mixture from the point of ignition to the liquid pool. The resulting "pool fire" is similar to any other pool fire where hydrocarbons, such as gasoline, or propane, are burning. The fire results from the combustion of the fuel vapors which have evaporated from the liquid pool and have been mixed with air to result in flammable concentrations. A pool fire can endanger the public, either through direct contact with the fire, or through heat radiated by the fire. It should be noted that it is in this context that the statement that "LNG does not burn", or variations thereon, is frequently found in the literature purporting to educate the public regarding LNG safety. While the statement is literally true, it is not helpful, and it can be seriously misleading, as the statement is also (literally) true if applied to any other liquid hydrocarbon fuel, including gasoline. It is misleading because the statement that LNG does not burn could imply that there is something different here from other hydrocarbon fuels such as gasoline – in this sense, there is not.

Vapor Cloud Fires - If the LNG is spilled and evaporates to form a gas mixture in which there are located no sources of ignition (an ignition source is a high temperature

source of energy such as a spark or flame), the gas-air mixture ("gas cloud") which forms, although possibly containing a large amount of gas that is in the flammable concentration range, will not ignite, and the cloud will drift until it either contacts an ignition source or all of the cloud becomes diluted below its *lower flammable limit* (approximately 5% methane in air) - it will then disperse harmlessly. If ignition occurs during the drifting of the cloud the result is a vapor cloud fire. If the gas cloud so formed is not ignited immediately it will be carried downwind, or will spread more or less radially (due to gravity forces on the heavier-than-air gas mixture) in the absence of wind. Both spreading by the wind and gravity spreading are accompanied by gas-air mixing and thus dilution of the cloud. If an ignition source is encountered at a location where the gas concentration is within the flammable concentration range, ignition will occur (at that location) and the fire will spread throughout the part of the cloud which is in the flammable concentration range. This is the so-called "flash fire" or vapor cloud fire. The vapor cloud fire can endanger the public, either through direct contact with the fire, or through heat radiated from the burning cloud. Finally, it is important to note that in the event that a flammable cloud were ignited, the fire would first burn through the portion of the cloud that had concentrations between the lower and upper flammable limit concentrates (for methane, approximately 5% and 15%) – this is a so-called premixed (fuel/air) fire. However it is of paramount importance to understand that the fire would then continue to burn throughout the cloud where concentrations above the higher flammable limit are present – this is a so-called diffusion flame, where the necessary oxygen for the

combustion would be added to the rich fuel mixture by air entrainment from the surroundings.

I want to state here my opinion that pool fires pose the greatest risk, based on the potential for high consequences *accompanied by the high probability that ignition will occur* as a result of the violent circumstances that would be expected to effect such a release – such as heat generated by collision forces, or sparks of impact or electrical system origin. However, as I have said above, the consequences of credible events that might occur that could impact public safety require determination *independently* of consideration of the likelihood of the occurrence. Finally, I note that the current federal regulations for siting LNG facilities require the determination of vapor cloud dispersion exclusion zones to protect the public safety, and no consideration is given to ignition probability in the determination of those vapor cloud exclusion zones. Therefore, it remains important to determine the potential consequences of delayed ignition of large flammable vapor clouds.

Vapor Cloud Explosion Hazard - The term explosion is used here to describe combustion reactions (that we normally call "burning", i.e., reaction of the gas in question with the oxygen in the air) which achieve such rapid rates that significant overpressures (local pressures higher than the atmospheric pressure) develop. Such overpressures can cause severe damage – they constitute the "blast" effect in conventional explosions. The forces released in conventional explosive materials (such as dynamite) typically result from very rapid *reactions of materials that are totally contained in the explosive material.* In such materials both the "fuel" and

the "oxidizer" are already present. In contrast, gas explosions such as are experienced with fuel gases such as methane or propane, cannot occur unless the gas (fuel) is mixed with air (containing oxygen) such that the mixture has a concentration within the flammable range (for methane this is approximately 5% to 15% methane in air). Such *physical* processes (as mixing with air), which are necessary for the gas to burn (or explode), place gas/air fires and explosions in a lower hazard class than materials like dynamite, which are "ready to go" if ignited, i.e., without the necessity that the material first be mixed with anything else. If a methane/air mixture within the flammable concentration range is ignited, the rate of reaction (the burning rate, i.e., how fast the flame moves through the gas mixture) varies depending on a number of factors, one of the most important of which is *confinement*. We all know that natural gas (normally principally composed of methane) explodes all of the time – *when it is confined*. We all have read about, and many have experienced, the blast effect that occurs when leaking (flammable) gas is released into a confined volume (say the kitchen) and its ignition (say by a light switch) blows the building apart. Conventional wisdom, as well as scientific opinion, held until fairly recently (the seventies) that unconfined gas/air clouds such as are formed by gases such as methane, propane, and the higher molecular weight hydrocarbon, will not explode if unconfined. This is important to the present discussion because it goes straight to the question of whether the cloud formed by LNG vapors mixing with air following a major LNG spill could explode (develop damaging overpressures) when the cloud is not confined. Today, damaging explosions (overpressures) of hydrocarbon gas/air

mixtures are a high-level concern because of accidents which have demonstrated the propensity of some hydrocarbon gases, when mixed to the correct proportions with air, to explode with devastating damage, *even when unconfined.* There is not time or space here to provide the details, but it can be stated that two such unconfined vapor cloud explosions (UCVEs) that occurred at Flixborough, England, in 1974, and in Pasadena, Texas, in 1989, were sufficiently devastating that they resulted in extensive changes in the regulatory requirements for dealing with chemical hazards in both countries.

What does this have to do with LNG? There is a scientific consensus (supported by experimental data) that methane/air mixtures which are unconfined are very unlikely to explode. The LNG industry and the Government are sufficiently confident of this fact that the explosion of an unconfined LNG vapor/air cloud is not considered credible. As a result, the most severe hazard is considered to be fire. I have studied this question, and I agree with the contention that methane/air mixtures are very unlikely to explode. But the story doesn't, or shouldn't, end there. It has already been stated that the composition of LNG imported into the United States varies significantly depending on several factors, most prominently the gas source location. LNG is imported from some locations that provide nearly pure methane. LNG is also imported from some other locations with concentrations of heavier hydrocarbons as high as 15-20%. Such gas is termed "hot gas" in the industry because its calorific value (energy content) is higher than an equivalent volume of methane. Typical heavy hydrocarbon gases present in LNG are ethane and propane, but others are present as well. Industrial accidents

have proven, with truly disastrous results, that some gas/air mixtures do explode when unconfined, and unconfined propane/air explosions, as well as other unconfined hydrocarbon/air explosions, have been observed.

Q. Dr. Havens, how might a fire occur following a breach of containment?

A. As I have said, there are two ways that very large fires can follow a major LNG spill. When LNG is spilled it will rapidly evaporate and the vapors will mix with air to form a vapor/air mixture that will burn in the concentration range of approximately 5% to 15% LNG vapor (assuming the LNG is essentially methane; the flammability limits as well as other indexes of the hazard must be reassessed if the LNG vapor contains important amounts of other hydrocarbon gases). Flammable mixtures of LNG vapor and air will inevitably form when LNG is spilled, and if an ignition source such as an open flame or spark are present, as would be highly likely to accompany the violent circumstances that would cause a major release, a large pool fire will result. However, if no ignition sources are present at any location where the gas/air mixture is in the flammable concentration range a vapor cloud will result, and the cloud will spread downwind from the spill until it either contacts an ignition source or becomes diluted below its flammable concentration limits. If a vapor cloud is ignited, the fire will burn through those parts of the cloud that are above the lower flammable limit concentration; if the vapor cloud is not ignited, it will disperse harmlessly (here too, the assumption is that the vapor cloud is essentially a mixture of methane and air; the potential for unconfined vapor cloud explosions must be considered if the LNG vapor contains important amounts of other hydrocarbon gases). In either

case, pool fire or vapor cloud fire, the damaging thermal radiation distances to which the people or property could be exposed provide the criteria for determination of exclusion zones to protect the public. It is the estimation of these distances, which are identified in 49 CFR 193 as thermal radiation distances and vapor cloud dispersion distances that I would like to discuss now. These distances are also referred to as a thermal exclusion zone and as a dispersion exclusion zone, respectively.

Q. How are the criteria for thermal exclusion zones and dispersion exclusion zones determined or defined?

A. Regarding thermal exclusion zones, although there are several criteria designed to protect property as well as people, the exclusion zone which precludes public occupancy is generally delineated in the LNG safety regulations by the distance from the fire, at ground level, at which thermal radiation fluxes of 5 KW/m^2 could be experienced. This is the heat flux level at which persons would be expected to experience second degree burns to unprotected skin in about 30 seconds. This thermal radiation flux is often expressed as 1600 Btu/ft^2-hr.

Regarding vapor cloud dispersion exclusion zones, the exclusion distances are delineated by the downwind distance at which the model-predicted gas concentration level falls below one-half of the lower flammability level (lfl/2), the one-half factor accounting for gas concentration fluctuations expected within the cloud.

Q. What do you mean by gas concentration fluctuations expected within the cloud?

A. The models used to calculate the expected concentration calculate an expected average, but the actual concentration at any point in the vapor cloud will be somewhat higher or somewhat lower than the expected average level at that point. As noted in the preamble to the final rule adopting the 2.5% concentration criterion, "The DEGADIS model predicts only average concentration of LNG. Because vapor does not disperse uniformly, pockets of 5% LFL concentration could be adjacent to the average distance line predicted by the model." 65 *Fed. Reg.* 10950, 10953 (March 1, 2000).

Q. Do you regard these criteria as sufficient?

A. I regard the lfl/2 criteria for vapor cloud exclusion distance as being generally sufficient, based upon my experience and study of the fluctuations in gas concentration that can be expected in such a vapor cloud.

However, I believe that the criterion of a 5 KW/m^2 flux level merits further consideration, because exposure at this intensity to persons could result in serious burns within time periods which would not be sufficient for evacuation or escape. Further, although fire fighting personnel equipped with protective gear could work in such an environment for considerable time, they would not be able to provide evacuation or removal of unprotected persons in time to prevent injury. This is especially true where the numbers of people that would need evacuation would number in the hundreds if not the thousands, and they would be scattered in scores or even hundreds of separate structures. Further, a large LNG fire could not be extinguished; it would simply continue to burn until the LNG is exhausted. It is known that the flux level would have to be reduced to about 1.5 KW/m^2

before unprotected persons could be exposed continuously without thermal radiation damage [this corresponds to a level of 480 Btus/ft^2-hr]. Consequently, I believe that serious consideration should be given to defining exclusion zones to protect the public from thermal radiation hazards using such a lower (~1.5 KW/m^2) thermal radiation flux criterion. However, whether or not DOT defines the exclusion zone using such a lower thermal radiation flux criterion, I believe that FERC should use the lower thermal flux criteria in order to protect the public from such very large fires. It is very important to recognize that a policy which prevents public presence where there would be exposure to 5 KW/m^2 is not consistent with the public interest, because the public could receive serious injuries at lower flux levels if exposed for longer time periods (including time periods that would still be insufficient to provide for sheltering or evacuation). That is why I suggest the consideration of the lower value of 1.5 KW/m^2 as the "safety" criterion – this value is widely recognized as being the highest value of thermal radiation exposure from which the public would not receive serious injury even if exposed for longer time periods.

Q. What is a "pool fire" and why is the potential for pool fires associated with the release of LNG a matter of concern?

A. The description "pool fire" is intended to describe a fire that is burning over, or attached to, a pool of liquid that is vaporizing and forming a flammable gas air mixture in the area adjacent to the vaporizing liquid pool. A common example would be a fire such as results if gasoline is spilled onto the ground (or onto water) and ignited. An LNG pool fire would result if LNG is spilled and the

combustible gas/air mixture emanating from the spill is ignited while there is some portion of the liquid remaining in the pool. The resulting fire is said to be attached or anchored to the pool. Such pool fires are a matter of concern because of the damage that can result from direct exposure to the fire (as being engulfed therein) but also from the high, and damaging, levels of thermal radiation (heat) that can extend to considerable distances beyond the fire's "edge".

Q. What is "vapor dispersion" and why is it a matter of concern when considering the implications to public health and safety of either an accidental or intentional breach of facilities or of tankers that would be associated with the operations of either the KeySpan or the Weaver's Cove proposals?

A. In the event that the vapors emanating from an LNG spill are not ignited more or less immediately, the LNG pool will continue to vaporize, as long as liquid remains, and it will form a vapor "cloud" over the liquid pool surface. Such vapors, if not ignited at that location, will continue to mix with air and spread, or disperse, from the spill location under the action of the wind or gravity effects on the cloud (which at the outset will be heavier than air). As the cloud disperses (downwind, normally) it will continue to be diluted with air. At some point, there will be determined a maximum extent to which flammable gas/air mixtures will occur. Beyond those distances, the cloud does not constitute a fire hazard. But within those distances, the cloud can be ignited and the result would be a fire that would burn through the portion of the cloud that had concentrations above the lower flammable limit concentration. Such fires are called vapor cloud fires, to distinguish them from the aforementioned pool fires. As in the case of pool fires,

I repeat -- LNG imported into the United States might be sufficiently lean in hot gas components as to not constitute a UVCE hazard; however, it is clear that the explosion hazard must not be hastily disregarded, for two reasons:

First, the natural gas produced in some fields around the world can, and frequently does, contain sufficient "hot" gas components to pose an explosion hazard; to the extent that LNG imported into the United States from various locations reflects the gas concentrations that are characteristic of those various gas fields there could be an explosive danger.

Second, in the event of spillage of LNG that contains some "hot" gas components, the vaporization process that occurs will result in enrichment in the heavier components during the latter phases of boil-off. This is because the heavier (higher molecular weight) components have a higher boiling point, so those heavier components will remain in the liquid state longer than will the methane. As a consequence, there is the potential for a spill of LNG that might be initially below the "hot gas" level of concern to form gas/air mixtures as a result of differential boiling that could constitute an explosive hazard.

Q. Dr. Havens, can you be more specific about these concerns as they would bear on the operation of either the KeySpan or the Weaver's Cove installation?

A. Yes. Considering first the tanker operations that would be associated with either installation, a single tank on a typical LNG carrier may contain six or more million gallons of liquefied natural gas. The fire from such a spill, if the spill occurred onto water and was therefore uncontained, would be very large, perhaps up to a half-mile in diameter, or larger if the other LNG tanks on the ship were to

fail. We have no experience with fires this large, but we do know that they could not be extinguished, they would just have to burn themselves out, and the radiant heat extending outward from the fires edge could cause serious burns to people at considerably larger distances. Again, an LNG tanker typically has five cargo tanks, with a combined capacity in excess of 30 million gallons, and ships are being designed to carry twice that amount.

The KeySpan and Weaver's Cove onshore storage facilities are intended to accommodate approximately 25 million and 53 million gallons respectively. While it would be unusual to anticipate an accidental breach of more than one tank on a tanker, or of an onshore facility breach that would threaten the release of all or even of a substantial percentage of the stored LNG, the same conclusions cannot comfortably be drawn about an intentional breach, particularly one that might be associated with a terrorist attack.

This raises one of the most significant issues presented by the KeySpan, Weaver's Cove, and associated applications: they force us to confront issues that extend well beyond our base of experience. We have some, but limited, history to fall back upon when considering the potential for and likely consequences of accidental breaches of containment; fortunately, we have no equivalent knowledge base when it comes to the assessment of intentional breaches. Accordingly, our study methodologies all assume the former but that in no way renders irrelevant the latter. To the contrary, it demands of us, and of the Commission in particular, increased vigilance.

Q. Please describe the principal safety regimes currently in place that deal with the transportation and storage of LNG.

A. The Department of Transportation has promulgated regulations which prescribe the requirements for siting LNG terminals in the United States. The Regulation is 49 CFR 193, and it is entitled LIQUEFIED NATURAL GAS FACILITIES: FEDERAL SAFETY STANDARDS. 49 CFR 193 was promulgated in the early eighties. Prior to the promulgation of 49 CFR 193, the requirements for siting LNG terminals were guided by the provisions of NFPA (National Fire Protection Association) 59A, entitled STANDARD FOR THE PRODUCTION, STORAGE, AND HANDLING OF LIQUEFIED NATURAL GAS (LNG). Following several revisions in 49 CFR 193 and NFPA 59A, the provisions of NFPA 59A have been incorporated in the latest version of 49 CFR 193, and it is that regulation that governs the siting of the proposed Weaver's Cove and KeySpan projects. Perhaps of greatest importance to the present discussion, 49 CFR 193 introduced the requirement for the determination of exclusion zones designed to protect the public from thermal radiation damage from LNG pool fires as well as from vapor cloud fires. 49 CFR 193 defines the terms "exclusion zone" as follows (quoting from the regulation):

"Exclusion zone means an area surrounding an LNG facility in which an operator or government agency legally controls all activities in accordance with Sec. 193.2057 and Sec. 193.2059 for as long as the facility is in operation".

49 CFR 193 was promulgated in the early Eighties in response to public concerns about LNG importation and peakshaving activities. To my knowledge, it was the first,

and remains the only, "consequence based" regulation of hazardous materials in our country. The LNG industry has objected to such measures, which effectively remove the option for the industry to utilize management systems to reduce the likelihood of an event so as to reduce the "risk", which they define (properly, in my opinion) as the product of probability and consequence, to an "acceptable" level. However, 49 CFR 193 clearly requires, with no consideration given to probability of occurrence, exclusion zones for LNG import terminals as well as peak-shaving and some other LNG storage facilities, and it must be assumed that as long as that regulation is in effect it suggests the necessity of such an approach to ensuring public safety.

However, it is of paramount importance to recognize that the requirement for exclusion zones is limited at present to the land-based component of an LNG import terminal. In my opinion, it makes no sense at all to provide such exclusion zones for part of the LNG facility and not for others. Several recent studies have shown that much more severe consequences can result from spill onto water than from spills on land. After all, this is largely a common sense issue, since spills onto water could not be contained, as can be accomplished on land, and the consequence zones would therefore extend to much greater distances.

At present the United States Coast Guard has safety jurisdiction over the marine transport of LNG. Because the present requirements for exclusion zones do not protect the public from spills of LNG onto the water from the LNG carriers that will serve these projects, the City of Fall River has petitioned the Coast Guard to consider implementing a rulemaking process to require determination of

exclusion zones to protect the public from spills onto water from LNG carriers that serve the terminal, both when they are at the terminal jetty or in route (loaded) thereto.

Q. In light of your recognition that there are regulatory regimes already in place governing both the shipment and storage of LNG and directed explicitly at assuring safety, why should the FERC concern itself at all with the safety of either the KeySpan or the Weaver's Cove facilities or of the associated marine transport?

A. There is, of course, the ultimate policy question that the FERC will have to address in exercising its judgment about the propriety of certifying either KeySpan or Weaver's Cove: because it is not possible to eliminate the possibility of a significant risk with the potential for very serious, even catastrophic, consequences to public health and safety, can certification of either of those projects be reconciled with the public interest where there are far safer alternatives available? I think not. Engineers are committed to problem solving in the way that is most efficacious, considering all objectives. Therefore, since I believe that safety of the public must rank high among the objectives that must be considered, as a matter of engineering judgment, I cannot see how it is possible to approve either the KeySpan or the Weaver's Cove applications.

Because it would not be possible to insulate the public from the potential for catastrophic risks associated with the operation of either KeySpan or of Weaver's Cove, I would reach the judgment that I have offered even if the existing regulatory regime were adequate to protect public safety in today's post 9/11

environment, but it plainly is not. That regime is seriously deficient in its ability to provide even minimal protection to the public in at least one respect, the failure to impose exclusion zones in association with marine transport. The Commission must not lose sight of the realities that necessarily surround this glaring omission. Please understand that I am not talking here about the need for marine traffic-exclusion or security zones around tankers while they are either in transit or berthed. I am talking of the failure to impose exclusion zones typical of those required around onshore facilities. Considering the congested nature of the waterways that these tankers will be required to traverse on almost an every-other-day basis, and the development that exists along the shorelines, this failing is most glaring and leaves a significant human population, not to mention critical components of the infrastructure (i. e., interstate and intrastate bridges, etc.) completely vulnerable.

Again, it is critically important to recognize that under the current regulatory regimes, exclusion zones are required to be calculated for spills in connection with the land-based portion of an LNG import terminal only; the regulations do not currently apply to spills that might occur from an LNG vessel onto water. But this failure can in no way be understood to imply that tanker spills can be viewed with indifference. Apart from the reality that accidental breaches of tanker containment cannot be eliminated as a risk, tankers must be considered particularly vulnerable to intentional breach, and it is critical that the vulnerabilities of tankers to cascading failures that might occur following an initial breach be considered most carefully.

Because spills on land are subject to a variety of control measures to limit the areal extent of the spill, such as dikes or impoundment systems, exclusion zones in support of requests for siting land-based LNG terminals are typically, in my experience, less than a half mile. However, if exclusion zones were required to protect the public from LNG spills onto water from an LNG vessel at the jetty or in route to or from the terminal, there is good scientific consensus that the fire radiation exclusion zones could extend to a mile or more if one-half of the contents of a single tank were rapidly spilled and, in the case of such a spill, the vapor cloud dispersion zone could extend to several miles. Obviously, if the regulations were applied to the determination of exclusion zones to protect the public from LNG tanker spills onto water, it would have a very important effect on siting decisions. It seems clear to me that such consideration would raise very serious concerns about the siting of LNG terminals where people within the exclusion zone distances would be endangered.

I want to state here again that I am extremely concerned that spills from LNG vessels caused by terrorist attack would most likely not be limited to the partial contents of a single tank on the vessel, as is widely assumed. It must be understood that the hazard distances that are now substantially agreed to result from a credible marine spill, which suggest fire radiation damage to more than a mile and potential vapor cloud travel exceeding two miles, would result from the rapid spillage of about 3,000,000 gallons of LNG onto water – this amount was chosen as a credible event partly (by most parties that have considered the question, including, most recently, the Sandia Laboratory) because it represents

about one half of one containment vessel on a typical LNG carrier operating today. It must be clearly understood, that because catastrophic cascading failures cannot be ruled out, this event can in no way be rationally considered the worst case event that must be considered.

Because of these concerns about the worst case events which require consideration, I wrote to the Secretary of Homeland Security in late February, 2004, to urge the Department to consider the vulnerability of LNG carriers to terrorist attacks as part of their deliberations on LNG terminal siting. As I stated in testimony before Congress on June 22, 2004, DHS has still not acknowledged receipt of my letter, much less replied. I do know that my letter was referred to the Department of Homeland Security, that the Department denied that foam plastic insulation was used on LNG carriers entering U.S. ports, and that the Department subsequently corrected its error – stating that the material is widely used to insulate LNG carriers. Furthermore, I believe that DHS may have referred my question to the Sandia Laboratory for assessment, since Sandia stated that the cascading events scenario about which I was, and remain, concerned, "could not be ruled out".

Q. Have any other analysts expressed similar concern about the potential for a breach of tanker containment?

A. Yes, recent analyses completed for FERC by the ABS Shipping Group entitled "Consequence Assessment Methods for Incidents Involving Releases from Liquefied Natural Gas Carriers" and by the Sandia National Laboratory entitled "Guidance on Risk Analysis and Safety Implications of a Large Liquefied Natural

Gas (LNG) Spill Over Water", which are attached as Exhibits C and D respectively, do just that. I believe that the scientific opinions that I am offering here are supported by the findings of the ABSG and Sandia reports, and I believe it is very important that the Sandia report addresses realistically the concerns I have raised about the potential for cascading events that might occur following such large spills and fires as are acknowledged as credible by both Sandia and ABSG. However, I do differ with Sandia in some of their conclusions. While the Sandia report states that it is unlikely that more than two or three of the separate cargo tanks could be released *at one time*, I believe there remains a clear indication that such events could result in the total loss of the ship and the burning of its entire contents. As I have stated before, typical ships now in service carry more than 30,000,000 gallons of LNG, and ships that are being proposed carry up to twice that amount.

Q. In your last answer you made reference to work done by the Sandia National Laboratory. Would you please tell us about that laboratory, the nature of the specific work that it was asked to undertake, and the results of the analytical effort that you find relevant to this proceeding?

A. The Sandia National Laboratory is one of several national laboratories developed as a result of the nuclear weapons programs that began with the Manhattan Project to build the first atomic bomb. More recently, as with the other national laboratories, Sandia has been identified as a depository of knowledge and scientific talent that more and more is being applied to a variety of technical/scientific problems that our country faces. Among such problem areas,

there is now a growing reliance on the technical expertise that resides at the national laboratories to advise policymakers regarding the post 9/11 terrorist threat, particularly the threat to the energy infrastructure of the nation.

I think it is important to review several events that occurred following 9/11 that I believe may have, at least in part, resulted in the Sandia report. Following 9/11, there were raised serious concerns about the potential for terrorist attacks on LNG infrastructure. The controversy at the time centered on the only LNG terminal in a major urban area – the Everett terminal in Boston Harbor. There were immediate calls for safety assessments, particularly regarding the tanker risks, and the Coast Guard denied entry to a loaded LNG tanker for a short period while the risk was being assessed. A rather hurriedly prepared report was prepared by Quest Consultants, Inc., of Norman, Oklahoma, for the Department of Energy that was intended to assess the risks attendant to LNG ship movement in Boston harbor. Although spills of the order of 12,500 cubic meters (one-half of one ship tank) were considered credible and were analyzed, the estimates of potential pool fire and vapor cloud damage zones were decidedly smaller than had been predicted by other scientists in the field, including me. As a result, presumably, at least in part, FERC commissioned another more thorough evaluation of the risks, and it was completed by the ABS Group as mentioned above. More or less simultaneously, the Department of Energy announced that Sandia was preparing an independent report also. The Sandia report was said to be particularly directed to terrorist attack concerns.

Because I believe that both the ABS Group and Sandia Reports are on the whole very good scientific efforts to grapple with the problem at hand, I have, and continue to recommend them to policymakers and the public. There were, from my point of view, two most important findings that followed from both reports. First, the estimates of the consequences of a half-tank spill in Boston Harbor reported by Quest, which suggested much lower hazard distances than had been predicted before, were stated by both reports to be unsubstantiated. Secondly, both reports clearly indicate the credibility of a spill of the size which I have been discussing, and both reports provide estimates of the pool fire and vapor cloud hazard distances that are in good agreement with the predictions by the scientific community that had been made before the appearance of the Quest Report.

In summary, I believe that the ABS Group and Sandia Reports add important substantiation to the estimates of potential consequences of a terrorist attack on an LNG tanker that the scientific community has previously made. Furthermore, as I have stated previously, the Sandia Report provides important substantiation of my concerns about the vulnerability of an LNG ship to cascading failures that could take place as a result of a terrorist attack. While I do take issue with the manner in which the separate matter of assessing the probability or likelihood of the events under consideration happening is handled in the Sandia Report, I believe that both of the reports substantiate the position that I and many others have taken all along on the potential consequences of both accident and terrorist causes of major releases of LNG that must be considered in the siting of LNG terminals.

Q. Are there any other respects in which you feel the current regulatory regime and the measurement tools that it imposes to be inadequate in today's environment?

A. I see the resolution of the LNG terminal siting issues in Fall River and Providence as a bellwether. I feel that the questions being considered here deserve the most careful consideration; the manner in which policymakers resolve these siting questions will resonate, and there are many other questions which will follow, indeed anticipating the outcome of these proceedings - all of them relating to the difficult balancing of risks and benefits to our country. Considering the very complicated situation in which we find ourselves because of the tremendous imbalance in the locations of supply and usage of the world's energy resources, I think the decisions taken on this LNG siting issue have the potential to set precedents which could well determine whether we will prevail in the difficult tasks we face.

Q. Dr. Havens, if we accept your conclusion that, to provide the public with even a minimal level of protection it is necessary to define exclusion zones around LNG marine transport, how extensive would those zones have to be?

A. I cannot answer the question definitively because it remains to be determined what the credible worst case conditions associated with a terrorist attack on a tanker would be. However, I believe I have sufficient information to allow an informed scientific opinion in this regard, especially relating to the designation of minimum criteria for such zones. I am continuing to study this matter carefully, and I believe that the findings in the Sandia and ABSG Reports provide a basis, with some extension, for a rational analysis to determine the consequences of

credible worst case conditions. However, such extensions, which as far as I know have not been heretofore considered, must be considered most carefully, as such extensions will require very careful consideration of the vulnerability of the tanker ships to the occurrence of successive failures following a massive spill such as has been considered above. It is in that area that I think we are entering new and unknown territory – but we cannot shrink from the necessity of exploring it.

But, let me dwell for the moment on what we know. The Sandia report suggests clearly that rapid release of half of one tank of LNG from a "typical" carrier is credible, and that a terrorist attack could therefore result in the release onto water of approximately 3 million gallons of LNG. I agree with this finding. Sandia further states that the pool fire that could result from such a major spill, if the LNG were ignited immediately, could cause second-degree burns to persons with unprotected skin in about 30 seconds out to a distance of at least 1 mile. I agree with this estimate also. However, as I have stated earlier, I believe that consideration should be given to the need to lower the thermal radiation flux criteria, which currently reflects the assumption that people without protection could receive second degree burns in about 30 seconds, to a value which would more appropriately delineate the zone beyond which the public would not be seriously impacted. It is well known and established that maximum thermal radiation flux levels which would allow exposure without serious injury are approximately equal to 1.5 KW/m^2. Using well established, 49 CFR 193 approved, methods for determining distances to specific thermal radiation flux

levels, it can be anticipated that the approximately one mile distances cited above for the exclusion zones around a half-tank ship spill pool fire on water would approximately double if the 1.5 KW/m^2 level were adopted. Whatever the exclusion zone under 49 CFR 193 might be, I believe that there could be a serious impact on the population in the entire area within two miles from the site of a half-tank ship spill pool fire on water.

Sandia states that if the spill were not ignited (upon spillage), a flammable vapor cloud could extend downwind to distances exceeding 2 miles. I believe this estimate may be somewhat low, but my best guess would be that the distance would probably not exceed 3 miles.

Finally, and perhaps most important at this point, the Sandia report states unequivocably that cascading events that could result either from brittle fracture of structural steel on the ship due to LNG contact with the steel, or failure of the LNG tank insulation by melting or decomposition (and the foam insulation widely used on LNG carriers would be highly susceptible to such failures) which could lead to vaporization of the cargo at rates exceeding the capability of the pressure relief valves, leading to a catastrophic failure of the entire tank, cannot be ruled out. I have already stated that I believe that such cascading failures, once in progress, would be highly likely to continue until the ship became a total loss. As I have stated, I do not believe that calculations have been made of the extents to which the public would be in danger following such a cascading failure mechanism, but I believe that such worst case events are important to consider, as

sufficient knowledge of those credible consequences is required in order to proceed with a rational estimate of risk to the public.

Given the above facts, I think that in order to provide an estimate of the extent of a zone surrounding an LNG tanker from which the general public should be prohibited, if possible, I would be remiss, considering the uncertainty involved, if I were to suggest a minimum distance less than two miles. As I have stated above, this two mile separation distance would reflect the assumption of the release being limited to approximately one-half of one LNG ship tank onto water. I continue to believe the potential for greater consequences that could follow such a release need to be most carefully considered.

Q. Dr. Havens, ignoring any inadequacies in the specification of "credible" events that must be considered (such as releases due to tank failure or destruction, on land, or from ship spills onto water), do the EIS's that have been prepared in connection with the approval process for either the KeySpan or the Weaver's Cove projects adequately delineate the full risks to public health and safety made evident by the correct application of current analytical measures and regulatory requirements?

A. Unfortunately, they do not. It is important to recognize that the current regulations, which have undergone revision in the last several years, appear to be increasingly directed at what are characterized as "design" spills rather than what I have identified as "credible" (possible) spills. Please let me expand.

First, it is a matter of common sense that if you select for analysis a spill small enough, the hazard extent will diminish to a point of no concern. For both

terminal applications, after identifying as credible the guillotine breakage of the largest LNG transfer line from the ship – followed by a ten minute duration spill at the full line transfer rate – the applicants have chosen to specify smaller consequence spills for analysis to determine the required exclusion zones. The result is to downplay the "credible" hazard.

Second, the modeling methodology prescribed in the regulations (49 CFR 193) has not been followed correctly. For both terminal applications, significant errors have been made in the analyses leading to the determination of the required exclusion zones. The results here are also to downplay the "credible" hazard.

Q. In the individual EIS's prepared for the KeySpan and for the Weaver's Cove projects, the judgment is expressed that the risk to the public is negligible. Do you agree?

A. I most certainly do not agree. Apart from the fact that the analyses fail to consider the worst case credible events that should be considered, the analyses importantly understate the adverse consequences that could result from the events they did consider.

Q. What are some of the more specific concerns that you have about the sufficiency of the safety analysis that has thus far been undertaken with respect to the Weaver's Cove project?

A. For the Weaver's Cove Project, the EIS (at 4-245) identifies the spill scenarios that must be considered for determining thermal and flammable vapor exclusion zones, for compliance with 49 CFR Part 193 and NFPA 59A, as follows:

1. One 1,260,000-barrel (200,000 m^3) LNG storage tank

2. The marine cargo transfer system consisting of

a. three 16-inch-diameter unloading arms,

b. one 16-inch-diameter vapor return line,

c. one 30-inch-diameter liquid unloading line to the storage tank,

d. and one 20-inch diameter vapor return line.

3. Five 2,120 gpm in-tank pumps and five 1,800 gpm sendout pumps.

4. Four vertical shall/tube type vaporizers - Same requirements as for LNG pumps.

I am now going to refer back to the DEIS, because there the Staff's logic is more fully set out, and it is therefore more clear where the Staff made significant errors. I will return to the EIS, and the additional matter set out there, a bit later in this testimony.

The DEIS states on page 4-194: "The calculations of thermal and flammable exclusion zones for the proposed LNG facilities are based on the dimensions of the proposed impoundment systems and the spill volumes specified by Part 193 and NFPA 59A. Weaver's Cove Energy states that any LNG spills occurring from the withdrawal header, the vaporizer and sendout pump area, the ship unloading line, or the truck transfer area would be directed to an impoundment .... This earthen impoundment, 140 feet x 140 feet with a depth of 5 feet, would have a capacity of 733,090 gallons and would contain a concrete sump, 59 feet by 59 feet with a depth of 4 feet, having a capacity of 104,158 gallons. The total capacity of the impoundment (including the sump) would be approximately 837,248 gallons."

Table 4.12.4-1 of the DEIS (page 4-195) then presents the impounding area and spill size volume for each of the 10-minute full flow spills, as follows:

Source	Spill Size (gallons)	Impoundment System	Impoundment Size (gallons)
Tank Pump Withdrawal Hdr	98,900	Impoundment Sump	104,158
Sendout Pumps/Vaporizers	72,000	Impoundment Sump	104,158
Truck Transfer Line	14,000	Impoundment Sump	104,158
Ship Unloading Line	608,000	Impoundment	837,248

Q. What is inappropriate about this analysis and the conclusions reached?

A. The DEIS goes on to state that Weaver's Cove selected the ambient conditions that would produce the maximum thermal radiation distances as follows - Windspeeds of 15 and 26.5 mph; ambient temperature of 12 F; and 50 percent relative humidity. The DEIS presents a summary table of the thermal radiation distances for incident flux levels of 1600, 3000, and 10000 BTU/ft^2-hr. The largest thermal exclusion zone is stated to be

995 feet, resulting from a fire atop the LNG storage tank containment. It is then stated that the 995 feet exclusion zone would extend over Route 79 toward the south, and the DEIS recommends that Weaver's Cove Energy provide evidence of its ability to exercise control over the activities that occur within the portions of the thermal exclusion zones that fall outside the site property line (page 4-196). However, it does not appear that the thermal exclusion zone that would be associated with the 608,000 gallon spill from the ship unloading line into the 837,248 gallon impoundment has been analyzed. Using Weaver's Cove selected ambient conditions (I used the 15 mph wind speed, without stipulating that it is the worst case) to calculate the thermal exclusion for the ship unloading line into the impoundment, using LNGFIRE, gives the following results:

Incident Flux Exclusion Zone (Btu/ft^2-hr)	Exclusion Zone (feet)
1,600	635

Although this thermal exclusion zone for the ship unloading line spill does not exceed the (995 feet) exclusion zone for the containment tank-top fire, it does exceed considerably the exclusion distance (320 feet) presented for the smaller "impoundment sump" spill. Consequently, the ship unloading line spill should be included in the safety and reliability analysis. More importantly, this failure to consider the ship unloading line spill is critically important because the

determination of the vapor cloud exclusion zone for the ship unloading line spill, which was not considered, indicates a clear danger to the public.

Q. Please explain the basis for your conclusion that the DEIS analysis does not accurately portray the full extent of the required vapor cloud exclusion zone.

A. There are two very significant errors in the DEIS determination of the vapor cloud exclusion zones for the Weaver's Cove Project. Quoting from the DEIS (page 4-197),

> "Weaver's Cove Energy calculated that 3,184,955 cubic feet (ft^3) of cold vapor would result from the vaporization of an in-tank pump withdrawal header spill. By considering the provisions for containing vapors under section 2.2.3.3, the entire volume of cold vapor could be contained by the facility's earthen ~ with a volumetric capacity of 7,171,695 ft^3. Therefore, the vapor dispersion exclusion zone would not extend beyond the earthen dike and thus would be contained within the LNG terminal site."

This assertion is incorrect and seriously misleading. The vapor volume (3,184,955 ft^3) calculated by Weaver's Cove assumes that the vapor will not warm (increase in temperature) above its -260 °F (initial) value, and that it will remain pure, i.e., it will not mix with air. Both assumptions are clearly in error, as it is physically impossible for the vapor from the spill to fill that portion of the earthen impoundment volume without warming or mixing with air.

The FEM3A model, acknowledged in the DEIS as being authorized by DOT for determination of vapor cloud dispersion exclusion zones, is directly applicable to this problem. My first hand experience with the FEM3A model indicates clearly that there is the potential for overflow of flammable vapors from the earthen dike

following the subject spill. Consequently, this scenario should be analyzed with the FEM3A model, as is clearly the intent of the regulation, since the scenario cannot be reliably modeled with the DEGADIS model.

However, I believe that Weaver's Cove has made a much more serious error, in my judgment, by not including in the DEIS a determination of the applicable vapor cloud exclusion zone for the postulated ship transfer line spill. This spill, as specified in the DEIS in Table 4.12.4-1 (page 4-195), would result in the collection of 608,000 gallons of LNG in an impoundment with dimensions 140 feet x 140 feet x 5 feet depth with a total volume of 837,248 gallons (including the smaller impoundment sump which is within the larger impoundment area). Using the ratio of liquid to vapor volume of 1:235 specified for the smaller pump withdrawal header spill, the ship transfer line spill would result in a volume of pure LNG vapor at -260 F of 19,101,604 cubic feet, more than twice as great as the volume of the earthen impoundment. This indicates that even without assuming that the gas will warm or mix with air, which of course will occur as a matter of physical necessity, the gas would clearly overflow the earthen dike structure.

Moreover, the FEM3A model, acknowledged in the DEIS as being authorized by DOT for determination of vapor cloud dispersion exclusion zones, is directly applicable to this problem. I have presented data obtained from wind tunnel simulations of the vapor cloud exclusion zone for a 0.5 m^3/s LNG spill from a ship transfer line into the annular space surrounding a 1 BCF (billion standard

cubic feet of methane) storage tank for a wind speed of approximately 5.7 m/s (approximately 13 miles per hour) in the following document:

Havens, J.A.. T.O. Spicer, and H.L. Walker. "Evaluation of Mitigation Methods for Accidental LNG Releases: Volume I/5 ---Wind Tunnel Experiments and Mathematical Model Simulations to Study Dispersion of a Vapor Cloud Formed following LNG Spillage into a Diked Area Surrounding a Storage Tank," Topical Report for Gas Research Institute, November 1996.

This document is the "experimental data" companion volume to the reference cited in 49 CFR 193 and NFPA 59A as the required procedure for application of the FEM3A model to spills of this kind. While the Weaver's Cove tank volume, and the associated earthen containment volume are approximately 4.4 times greater than the example calculation described, it is a straightforward matter to scale these wind tunnel results to get an indication of the vapor cloud exclusion zone applicable to the 10-minute duration ship transfer line spill specified in the Weaver's Cove DEIS. The exclusion zone thus determined is approximately 850 meters (2,788 feet). This exclusion zone clearly extends well beyond the Weavers Cove control line.

In summary, I believe that the errors identified above in the DEIS for the Weaver's Cove LNG Project are extremely important, since it follows that if the intent of the regulations is followed, the procedures for determining the vapor exclusion zones for releases from the land-side portion of the facility will indicate significant danger to the public.

Q. Dr. Havens, didn't Weaver's Cove already respond to many of the criticisms that you submitted in response to the analysis offered in the DEIS?

A. It responded, but erroneously.

Q. For clarity, let us deal separately with the disagreements advanced by Weaver's Cove to your comments. Weaver's Cove has advanced the contention that its calculations were performed in strict conformance to the requirements and methodologies approved by DOT and by the Commission and, therefore, that your contentions that the extent of the vapor cloud dispersion and the potential for it to extend beyond the intended impoundment and pose a health and safety risk to the general population, are erroneous. What is your response?

A. In dismissing my comments in this fashion, Weaver's Cove has demonstrated a profound misunderstanding of the governing regulatory requirements and of the scientific methods that are specified for determining exclusion zones. Its principal error is its reliance on inadequate methodology to determine the rate at which the vapor cloud that forms in the impoundment area will overflow the outer earthen dike that surrounds the facility. It is important that the Commission understand that the modeling of vapor cloud dispersion associated with LNG containment breaches has been an evolving science. I am fortunate to have played a role throughout that evolution. What is important here is to realize that Weaver's Cove has utilized, and the DEIS appears to sanction the utilization of, a methodology proposed in a technical document note by Mr. Walt Dennis written in 1986. However, Weaver's Cove has chosen to ignore a critically important caveat contemporaneously added by Mr. Dennis at that time. When he proposed

the method in question, Mr. Dennis advised that because of its inadequacies it should be used only as an *interim tool, until a more satisfactory methodology was developed.* In the "technical note" that DOT issued at the time, and to which Weaver's Cove has referred in response to my criticisms of this part of the DEIS, Mr. Dennis admonished:

"Because of limitations in predictive capability of the current model, costs for protection distance at new plants could be economically burdensome. Preclusion of expansion at most existing plants would be likely. Yet unsafe conditions could prevail with certain designs. OPS recognized this problem even at the writing of current standards, but available options were limited."

In summary, the methodology suggested by Mr. Dennis, which prescribes the method to determine the rate at which a vapor cloud would overtop the impoundment (thus setting the initial conditions for dispersion) was sanctioned for use on an interim basis, until the research that already had commenced was complete and provided more accurate information relating to this issue.

Q. Dr. Havens, did that research effort ultimately bear fruit?

A. It most certainly did. The Department of Transportation's Office of Pipeline Safety (OPS) had initiated a six-phase research program in 1983 and subsequently, the Gas Research Institute (GRI) joined the effort as a co-sponsor. According to the study sponsors, the effort was directed at the development of definitive and verifiable methodologies and procedures for the application of wind tunnel simulations either independently or in conjunction with mathematical

models for the prediction of vapor dispersion distance where diffusion is influenced by: (a) eddy entrainment from excess capacity LNG vapor detention systems, (b) wake turbulence from on site structures and natural obstacles, and (c) topographically induced diversion or meander. "Independent physical simulation will be dependent on scale. With such methodologies, protective distance for dispersion may be safely reduced by as much as one order of magnitude with tank top transfer and designs to provide the conditions described in (a), (b), and (c) above. Although results of this effort will not be in place until after 1988, it may be useful for you and operators under your jurisdiction to be aware of this potential development in planning for expansion."

Q. Dr. Havens, did you participate in that study effort?

A. Yes. I served as the principal investigator on the wind tunnel parts of the research program that Mr. Dennis referred to in the closing paragraphs of his technical note. It was to results of that (wind tunnel) research program that I referred to (in my comments to FERC on the Weaver's Cove DEIS) as demonstrating the error in the method that Weaver's Cove had used (and for which they had cited Mr. Dennis' technical note as authority). I stand by my comments that data obtained in my laboratory during that period demonstrate that the methodology utilized by Weaver's Cove in support of its filing with the Commission is erroneous.

Q. Was there additional research completed as part of that six-phase effort that is of relevance here?

A. Yes. DOT and GRI, in the same six-phase program described by Mr. Dennis,

conducted the "Falcon" tests at the Department of Energy's Liquefied Gaseous Fuels Spill Test Facility (LGFSTF) Nevada Test Site. The Falcon tests were large scale field tests designed to determine the effectiveness of vapor fences for decreasing the required vapor cloud exclusion distances.

The tests were designed to provide large scale test data that would address this question.

The Falcon test series was performed at the Liquefied Gaseous Fuels Spill Test Facility at the Nevada Test Site by the Lawrence Livermore National Laboratory (LLNL) for DOT and GRI in 1987.

The test series involved five large-scale releases of liquefied natural gas into a fenced (vapor-containment) area with total volume (for vapor containment) of 38,720 cubic meters. The Table following shows the LNG volumes spilled in each test, along with the volume of cold LNG vapor that would be evolved (again, this assumes that the gas did not warm above the -260 °F temperature of the (liquid) LNG, and that the vapor remained pure, i.e., it did not mix with air). The fourth cclumn shows the ratio of the aforementioned volume of LNG vapor formed to the containment volume (Vapor Fill Ratio).

Falcon	LNG Spilled (m^3)	LNG Vapor Formed (m^3)	Vapor Fill Ratio
1	66.4	17,928	0.463
2	20.6	5,562	0.144
3	50.7	13,689	0.353
4	44.9	12,123	0.313

Q. Dr. Havens, what conclusions must the Commission draw from those tests?

A. The result of these tests that is important here is that, when the tests were conducted, flammable gas/air mixtures overflowed the fence (vapor containment) and flammable concentrations extended downwind of the fenced (vapor containment) area in all four tests. In fact, the 2.5% gas concentration extended to approximately 240 meters (787 feet) in the largest test (Falcon 1). Had the assumption made by Weaver's Cove and adopted in the EIS been applicable, no gas would have overflowed the fence in any of the Falcon Tests, because the volume of the gas cloud would have been smaller than the volume within the dike and would therefore have been contained therein. Accordingly, the important significance of the Falcon test results to the present proceeding is the fact that they indicate clearly that the assumptions made about vapor containment in the Weaver's Cove EIS are wrong. I note also that the conclusions that these assumptions are erroneous is reinforced by independent wind tunnel testing performed in my laboratory, testing which corroborates the conclusion that the vapor dispersion exclusion zones (or lack thereof) claimed by Weaver's Cove for the LNG terminal in Fall River would, to a significant extent, underestimate the extent of the vapor cloud exclusion zones that would be necessary for protection of the public.

Q. Have you published anything regarding the matters we have just discussed?

A. Yes. I presented a paper directed specifically to these issues at the Spring National Meeting of the American Institute of Chemical Engineers in Atlanta in April of this year (2005). This paper, which is attached as Exhibit E, details all of

the arguments I have presented here. I note also that this paper, with appropriate editorial revision, has been peer reviewed and accepted for publication in the American Institute of Chemical Engineers journal "Process Safety Progress".

Q. Weaver's Cove also challenged your assertion that the FEM3A model was available to it for use in calculating the vapor cloud exclusion zone. Is its contention of unavailability well founded?

A. Absolutely not. The FEM3A model was most assuredly available to Weaver's Cove and I believe that the regulatory assumption is that it would be used in these circumstances. The FEM3A model has been specified for use in 49 CFR 193 beginning as early as 2001, and the model is available from the Gas Technology Institute, as Weaver's Cove should have known and as I advised it in response to an inquiry from its law firm. It is my understanding that the law firm subsequently confirmed the availability of the model, but to my knowledge neither Weaver's Cove nor their representative has ever actually requested a copy. It certainly has not seen fit to offer the Commission the benefit of consideration of the results obtained from application of the model.

Q. Finally, in terms of the responses offered on behalf of Weaver's Cove to your comments on the inadequacy of, and errors in, the analysis contained in the DEIS, it points out that you lack the expertise to predict the probability of an accidental or intentional release. What is your response?

A. I do not profess to be an expert on the probability of accidental risk. However, I yield to no one in terms of knowledge about the history of accidents in the LNG industry, and it is that experiential base, not some theoretical probability estimate,

upon which I base my conviction that it should be assumed that the likelihood of an accidental release of LNG occurring during the lifetime of the Weaver's Cove facility is extremely high. However, I want to make it very clear that my principal concerns at this juncture is the overriding need to consider the consequences that could occur from a terrorist attack on the LNG infrastructure. I am convinced that we have to consider such questions completely differently post 9/11, and I am concerned that the public should not be lulled into a false sense of security about the threat of terrorism related events to LNG infrastructure being downplayed based on the LNG industries safety record. The fact remains that associating probabilities for the occurrence of events such as are being considered here, which are considered to result primarily from human error, with past performance records is not applicable in any way to the assignment of probabilities of an event that is intentional. I have said before, and I believe sincerely, that the involvement of malicious intent forces us to change the rules used to consider this most important problem. Regarding the performance of the industry relating to the occurrence of accidental events, I have attached to this testimony, as Exhibit F, a report compiled by Quest Consultants about the accidents that have occurred to date. I have been personally involved in several incidents described therein - I was asked by the U.S. Coast Guard to investigate one particular accidental LNG release that occurred in Arzew, Algeria, in 1977, at which one person was killed, and I investigated for the Coast Guard the flammable vapor cloud explosion that occurred on the crude oil carrier Sansinena in Los Angeles harbor in 1977 with catastrophic loss. Moreover, I am familiar

with many of the others events cited in the attached report because of my regular attendance at technical symposia addressed to this subject area and because I make a practice of keeping abreast of the pertinent literature.

Again in terms of intentional attacks resulting in containment breaches, I confess to no special expertise except for an acute understanding of the ways in which such an attack can cause havoc and horrendous consequences to public health and safety. If the Commission doubts that these facilities present would-be terrorists with most attractive targets of opportunity, and that the potential for unleashing catastrophic harm is not at all beyond the ability of even a moderately astute terrorist to accomplish, I would be glad to discuss the opportunities that would be presented, but only in a hearing context that protects against public dissemination of my comments. It is not that I would be saying things that unfortunately would not already be obvious to reasonably sophisticated terrorists, I simply am loathe to extend the knowledge base.

Q. Dr. Havens, were your concerns described just now provided FERC before the comment period on the Weaver's Cove DEIS ended?

A. Yes, my concerns were contained in a report which I prepared for the City of Fall River, dated August 25, 2004, and which Fall River filed with FERC a few days later – before the comment period ended. That report is attached hereto as Exhibit G.

Q. You have described the rebuttal by Weaver's Cove to your report to Fall River, along with your reply to their rebuttal. Has either Weaver's Cove or FERC ever replied to your explanation of your concerns that you offered in your reply?

A. Weaver's Cove never replied. When FERC issued the final environmental impact statement (FEIS) for the Weaver's Cove Project, they did acknowledge, if in passing, my concerns that the provisions and intent of 49 CFR 193 had not been followed correctly or carefully.

Q. Dr. Havens, did the FEIS for the Weaver's Cove Project address satisfactorily to you the concerns you raised in your report to Fall River?

A. It most certainly did not.

Q. Please explain.

A. My report to Fall River on the Weaver's Cove DEIS pointed out several very serious concerns that I had for public safety if the LNG import terminal were cited in the proposed location in the Taunton River. I have already described the two principal areas of my concern:

First, I was convinced, and remain convinced, that the provisions and intent of 49 CFR 193 had not been followed correctly for the land-based portion of the proposed facility, and that such failure had the effect of downplaying, if not disregarding, certain very real hazards that could affect the public around the facility should releases of LNG, either accidental or the result of malicious intent, that have been heretofore assumed to be reasonably and practicably credible, occur.

Second, I was convinced, and remain convinced, that failure to consider the necessity of establishing exclusion zones to protect the public from LNG spills that could occur from the tanker, either while at the terminal jetty or in route thereto, leaves a gaping hole in any regulatory plan which is obliged to insure to

the public a degree of confidence that government is guaranteeing them, at the very least, a full and fair consideration of the risks which must be considered, more soberly than ever, since 9/11.

Q. Dr. Havens, will you explain how you believe the FEIS failed to adequately address your concerns that the provisions and intent of 49 CFR 193 had not been followed correctly?

A. I had, and still have, concerns that neither the thermal exclusion zones nor the vapor cloud exclusion zones that were "presented" in the DEIS or the subsequent FEIS provide for protection of the public from the spills that have been planned specifically for by the requirements for construction of impounding basins for the collection of those spills, for two reasons:

First, FERC Staff continues (in the FEIS) to distinguish between spills for which impoundment basins must be provided for and so-called "design spills" which exclusion zones must be provided for. It is just plain common sense that the requirement for provision of an impounding basin, designed to ensure that a liquid spill could not spread beyond its confines, effectively defines such a spill as being "credible" – otherwise, it would not be necessary to provide it. It seems to me that it is in disrespect to the public's, as well as my own, common sense to argue on the one hand that impoundment systems must be built to insure the collection of such spills of LNG (liquid), while on the other hand closing their (FERC's) eyes to consideration of either of the events that would most assuredly follow – either a pool fire, if early ignition occurred, or a vapor cloud that would form if early ignition did not occur. But that is just what FERC did in the DEIS and

continues to do in the FEIS. Instead of determining either thermal radiation or vapor cloud exclusion zones for the 627,127 gallon spill from the ship unloading line (increased from the 608,000 gallon size considered in the DEIS) for which they require an impoundment basin to preclude further liquid spreading, FERC "chooses" in the FEIS to define the associated "design" spill for the LNG ship unloading line to be a 52, 257 gallon spill from a 4-inch-diameter valve bypass on the unloading line to be a "more appropriate credible" accidental leakage source for which to determine the exclusion zones. I have no idea what "more appropriate credible" means, but it makes absolutely no sense to me to argue that the ship unloading line spill is credible "enough" to require the liquid containment basin therefor, but not credible "enough" to require planning for the inevitable results of that spill. This appears to be a sloppy, non-scientific play on words that I find very discomforting, coming as it does from the agency that is responsible for ensuring fair and careful consideration of the public interest in this matter. Furthermore, I am aware, having analyzed other DEIS and FEIS's that have been prepared for LNG import terminals under consideration currently by FERC, that FERC has not been consistent in their handling of this matter. Several of the DEIS and FEIS's, all prepared presumably by the same FERC staff, have determined exclusion zones (if incorrectly) for the ship unloading line spills from guillotine breaks with full flow for ten minutes – just as I believe was intended by those who promulgated 49 CFR 193. Please understand that this is not an "academic" matter – if a vapor cloud exclusion zone is determined for the ship unloading line spill, as plain common sense dictates in view of the requirement

for an impoundment therefor, the vapor exclusion zone extents will, in my opinion, require FERC to deny the projects, both in Fall River and Providence, or provide for exception to the requirements of 49 CFR 193. Furthermore, as I have suggested that consideration be given to establishing the lower limit criteria for damaging thermal flux level of approximately 1.5 kw/m^2 in order to provide safe separation distances for the public from such fires, I want to make it clear that lowering the thermal flux level criteria to a value that would be consistent with public safety requirements would also substantially increase the distances calculated as thermal radiation exclusion distances, and that such distances would be likely to preclude, on their own merit, the siting of either of these terminals. Second, although FERC recommended that the impoundment basin required for the in-tank pump withdrawal header be resized to provide for a larger spill (124, 391 gallon) than was specified in the DEIS (98,900 gallons), FERC staff continues to use the same methodology used in the DEIS for determining the overflow of vapor from the impoundment(s). Thus, FERC continues to assume that the vapor evolved from the spill neither warms nor mixes with air as it fills the impoundment volume. FERC seems to insist that the applicable regulation specifies the propriety of this methodology. While that methodology was once considered the appropriate way to set the starting conditions for the use of DEGADIS, it is incumbent on the FERC to keep abreast of the scientific and development advances which have occurred since the methodology in question was proposed as an interim measure in the mid-Eighties. As I have stated before, I have presented a paper detailing the errors in methodology that I believe FERC

continues to embrace in the Weaver's Cove FEIS. I must say that although I have presented the arguments contained therein in several venues, including a well-attended session on LNG at the recent National AICHE meeting in Atlanta, I have not received any objection or rebuttal of my contentions in the paper. On the contrary, there has been uniform acceptance of the points which I have made as well as uniform agreement that the questions I have raised merit the most careful evaluation. I certainly stand ready to debate the questions I have raised about the determination of realistic and accurate exclusion zones necessary for safe siting of LNG terminals, and I hope that I will be given the opportunity to do so.

Q. Dr. Havens, will you explain why you think the FERC in the FEIS has failed to address your concerns about the necessity of establishing exclusion zones to protect the public from marine spills of LNG?

A. I can find no suggestion in the FEIS that they seriously considered my appeal. On the contrary, the FEIS appears to stand by the position they took in the DEIS, and I continue to believe that FERC is failing to provide the public the assurance they deserve that they are being protected from marine spills of LNG to at least the extent to which they are currently protected from spills on the land side of LNG import terminals.

Q. Dr. Havens, if the Commission were to accept your concerns and challenges, would it not have to reach the conclusion that it is not possible to certificate any LNG project?

A. Most certainly not. As I have stated, I have some serious concerns about the adequacy of the regulatory models used today in the assessment of risk,

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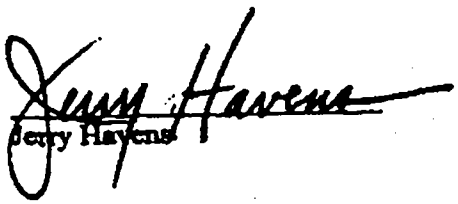
UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Weaver's Cove Energy, L.L.C. and)	Docket Nos. CP04-36-000, CP04-41-000,
)	
Mill River Pipeline, L.L. C.)	CP04-42-000, and CP04-43-000
)	

DECLARATION OF WITNESS

I, Jerry Havens, declare under penalty of perjury that the statements contained in the Prepared Direct Testimony of Jerry Havens on behalf of the City of Fall River and the Attorney General of the Commonwealth of Massachusetts in this proceeding are true and correct to the best of my knowledge, information, and belief.

Executed on this 3rd day of June, 2005.



Jerry Havens

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

WEAVER'S COVE ENERGY, LLC	)	**Docket #CP04-36-000**
MILL RIVER PIPELINE, LLC	)	**Docket # CP04-41-000**
	)	**CP04-42-000**
	)	**CP04-43-000**

AFFIDAVIT OF EVAN E. SMITH

I, Evan E. Smith, state on personal knowledge:

1) I am the President and CEO of the Newport County Convention and Visitors' Bureau (NCCVB). In this role, I am charged with fulfilling the mission of the organization – to promote Newport County as a premiere destination for leisure and business travel and to grow and develop Newport County's multi-million dollar tourism industry. I have been involved in the travel industry for 25 years, having served the NCCVB as Vice President /Marketing for 14 years and President for one year. In my present capacity, I oversee all sales, marketing and visitors' services programs of the NCCVB, as well as seek out new opportunities for growth through tourism.

2) I am highly familiar with the tourism industry for Newport County and the potential impacts to that industry from the inland waterway transit of LNG tankers. The impacts can be grouped into two categories: those resulting from Bay closures; and those resulting from bridge closures.

3) I understand that the LNG tankers would be making about 140 trips a year along the narrow East Passage of Narragansett Bay on a route contiguous with the coastal community of Newport and under the Pell Bridge, as they proceed to and from the liquefied natural gas terminal that Weaver's Cove has proposed to locate in Fall River. I also understand that the LNG tankers are approximately 950 feet long, have a beam of 145 feet and are 130 feet high, with a loaded draft of 37.5 feet; during each of these 140 passages, LNG tankers have a security and safety zone of through which recreational boats are forbidden to pass; and, for safety and security reasons, the Pell Bridge would be required to be closed for between six and twenty minutes for each LNG tanker transit.

4) It is also my understanding that, in Boston, the busy Tobin Bridge closes for 20 minutes or so each time an LNG ship passes beneath, and that, in all enclosed waterways, "moving safety zones," enforced by Coast Guard boats with heavy machine guns, close wide swaths of water to other boats as the ships come and go. According to one of the FERC commissioners, the safety and security zones enforced around each LNG ship and the unloading facility "could result in recreational boating delays of up to 60 minutes." The commission concluded that, "[I]n addition, recreational boaters could be prevented from boating or fishing in the vicinity of a moored LNG ship for approximately 24 hours."; and considering the ships can only make transit during a rising tide, this may occur quite often.

5) According to the Coast Guard, "the safety and security zones are needed to safeguard the public, high interest vessels and their crews, and other vessels and their crews, and [the port] from sabotage or other subversive acts, accidents or other causes of a similar nature." In sum, these regulations prohibit the simultaneous use of the channel by any other vessels, including those engaged in recreational activities, sightseeing, or commercial fishing, during both the outbound and inbound transit of high interest vessels, each of which lasts about three hours.

6) Newport, Rhode Island, is the sailing capital of the world. There are more yacht clubs in the southern portion of the East Passage of Narragansett Bay, between Acquidneck Island and Conanicut Island, probably than any other yachting community in the world; they include Newport Yacht Club, New York Yacht Club, Ida Lewis Yacht Club, Conanicut Yacht Club, and Jamestown Yacht Club. These clubs all run public instructional sailing programs and sailing regattas on Narragansett Bay between Newport and Jamestown. In addition, there are at least four sailing schools in Newport -- Sail Newport, Offshore Sailing, JWorld, and Performance Sailing -- all of which rely on usage of the inland Bay between Newport and Jamestown to run their instructional and community sailing programs and regattas. Children, from age seven and up, as well as adults fill this area of the Bay with virtually hundreds of small sailboats (optis, prams, and 420's) each week of the summer.

7) Newport hosts some of the most prestigious international regattas in the world in Narragansett Bay, including the Swan Nationals (300 boats sailed by world class sailors from all over the world), the Ensign Nationals, the US regatta for the UBS trophy, the America's Cup defenses, the Newport to Bermuda race, and the Sail Newport Match Race Championship for the IYAC Cup, just to name a few. Most of these races are seven-day series off the waters of Newport.

8) For many of these events, Newport competes with other communities to serve as host, such as San Diego, San Francisco, Corpus Christi, Key

West, Ft. Lauderdale and Wrightsville Beach. The most important factor in choosing a racing venue is the ability to keep an event on schedule. If an event has to be delayed or called off for a day, due to an LNG tanker passage or anchorage, it would erode the confidence of event organizers in Newport as a desirable sailing venue and organizers would likely begin to choose alternative venues as a result of closure of the Bay from Castle Hill to the bridge 140 times a year. Regattas result in direct expenditures into the Newport economy of millions of dollars.

9) The cruise ship industry would also be impacted by the LNG tanker transits required by the Weaver's Cove Project. Newport is a point of destination for numerous cruise ship lines. With LNG tanker deliveries, once or twice a week, there would be about twenty days out of the year that cruise ships would be precluded from anchoring in the Bay adjacent to Newport. The cruise ships bring about 60,000 passengers a year, who each average about $107 per person per port, which amounts to a $6.5 million industry for Newport. Because cruise lines schedule and book trips to Newport months in advance, it would take only one instance where a ship was denied entry into or anchorage in the Bay to erode the confidence of companies in Newport as a reliable Port of Call. These ships need a commitment for arrival and anchorage dates, and if we cannot guarantee that they will be able to access the waters off of Newport, then they will not come.

10) Numerous other businesses, which rely on the recreational use of the bay, would be devastated by the LNG tanker transits. In particular, one of the many other attractions for which people come from all over the country and all over the world to Newport is the substantial number of harbor cruise and sailing charter businesses, including the following: the Madeleine, the Adirondack, the Aurora, the Spirit of Newport, the America's Cup yacht charters, and the Rum Runner, just to name a few. These companies would all have to cancel scheduled tours because of LNG tanker transits. In turn, this would reduce the likelihood that convention organizers, who view such activities as an attraction to the area, would choose Newport as the venue for national or international conventions. Newport county has 3,000 rooms and 90,000 square feet of meeting space – excluding the varous banquet rooms in Newport's restaurants – available for conventions.

11) If the ability to take advantage of these recreational and scenic uses of the Bay is undermined, by the prohibition on the simultaneous use of the channel by recreational boaters for the periods of time that each LNG tanker passes Newport, this in turn would have a deleterious effect on other businesses as well, such as recreational and commercial fishermen.

12) The disruptive force of the greatest magnitude from the proposed Weaver's Cove Project, however, would be that caused by the closure of the Newport (Claiborne Pell) Bridge to automobiles. The Rhode Island Bridge and Turnpike Authority has determined that, like the Tobin Bridge in Boston, the Pell Bridge would have to be closed for all LNG tanker transits. The bridge is the lifeline of Newport tourism, connecting tourists to Newport from all points north, south and west, including New York, New England, and the national and international travelers who come into New York, Boston, Hartford and Providence airports.

13) In addition, the 6,000 residents of Jamestown on Conanicut Island, the island between Newport and the mainland of the west passage of the bay, also rely on the bridge to remain open to receive emergency medical services at the closest hospital – Newport Hospital, to attend school (St. Michael's Country Day, Pennfield, Salve Regina College, etc.), to attend routine medical and dental appointments, to do a substantial portion of their retail shopping, to eat at restaurants, and to attend cultural events (including theatres and cinemas), etc. Due to cumulative traffic back-ups and paralysis from bridge closures, and the consequent delays due to the time it takes for the traffic jam to unwind, persons being transported by ambulance to the hospital may die, children may be late for school, workers may be fired for tardiness, jurors may be unable to get to the Newport Courthouse, from points north, south and west, and tourists would miss scheduled events, concerts, etc. This would greatly affect the local economy of Newport, and surrounding areas, which depend on this influx of local, national and international tourists and customers arriving to Newport.

14) The Newport mansions alone bring in one million visitors a year to Newport. Virtually all of these visitors all arrive by way of the Pell Bridge. The tourism industry, which has grown by nearly 40 percent in the last three years, is one of the state's most important economic engines, generating as much as $100 million in annual economic impact. Rhode Island's largest and most-visited cultural organization is the Preservation Society of Newport County, which preserves and protects the best of Newport County's architectural heritage. Better known as the Newport Mansions, the Preservation Society maintains 14 historic sites in Newport and Portsmouth; 11 of those are open to the public for tours. The Newport Mansions have set attendance records in three of the last four years and increased the Society's annual operating budget from $11 million to $17 million in that time. In 2001, the mansions drew more than 933,000 paid admissions, making them the largest tourist attraction in the state, and the fourth-largest and fastest-growing cultural attraction in the entire six-state New England region. During August, September and October of 2001, the Newport Mansions surpassed the Museum of Fine Arts and Museum of

Science in Boston in attendance. And the Breakers and Marble House are among the 25 most-visited house museums in the United States.

15) The organization owns and operates one of the finest collections of historic buildings in America. The Society's house museums span three centuries of America's architectural and social development, from the colonial to the grand summer "cottages" of the Gilded Age. Five are National Historic Landmarks. Ten are designated as official projects of Save America's Treasures, a public-private partnership between the White House Millennium Council and the National Trust for Historic Preservation, dedicated to the preservation of our nation's irreplaceable historic and cultural treasures for future generations. The Breakers alone sees nearly 400,000 visitors a year.

16) The impact of the Newport Mansions on the regional economy is significant. A study by the University of Rhode Island indicates that visitors to the Preservation Society added nearly $58 million to the Newport County economy in 2000 alone. Forty-nine million dollars of that was spent in Newport hotels, restaurants, inns, retail stores and for transportation in and around Newport. The remaining $9 million received by the Preservation Society was paid back to the community in wages to its nearly 400 full-time and seasonal employees, business services contracted by the Preservation Society, and rent paid on facilities such as the society's two stores located in downtown Newport.

17) The Newport mansions alone bring in one million visitors a year to Newport. Business analysts have concluded that each dollar earned by an attraction in a city like Newport is re-spent in the region more than one and one half times. So the annual economic activity from visitors to Newport attractions, like the mansions, approaches $100 million, making it a major tourism force and regional economic engine.

18) The Newport economy, therefore, is largely dependent on tourism, and therefore closures of the Newport Pell Bridge and the Bay would have a serious negative impact on Newport's economy. The state of Rhode Island generally recognizes the importance of tourism to the local economy. The travel and tourism industry is one of the nation's largest sources of employment. Approximately 7.8 million people are directly employed by the industry and another 11.5 million indirectly. According to the Rhode Island Hospitality and Tourism Association, Rhode Island boasts more than 61,000 jobs in the travel, hospitality and related industries. The tourism economy of Newport, this economic activity and jobs, is inextricably intertwined with its history and character as a world-class yachting center overlooking scenic Narragansett Bay, one of the most pristine bays in the country.

19) Finally, because of the number of people that would be directly affected if there were an accidental or deliberate breach of an LNG tanker resulting in a spill of LNG in the East Passage of the Bay just south of the Pell Bridge, such an event, which I understand that both FERC and numerous national terrorism experts have recognized as a realistic scenario, would be catastrophic. Almost 30,000 people reside in Newport, and that number does not include the massive transient tourist population located in the area all year long, but especially from May through October. Newport is a densely populated City, with over 3,336 persons per square mile, in the second most densely populated state in the country.

20) Such populations as the residents of Newport and Jamestown, the tourists, the employees of Newport Hospital, and the employees of the Naval War College, would be in the second degree burn and low flammability zone of an LNG tanker spill. In addition, the Community College of Rhode Island is opening a brand new Newport County Campus, which officials project will reach an East Bay enrollment of 2,000 students in their facility. That facility, located just off of Coddington Highway, in the north end of Newport, less than a half-mile from the Pell Bridge, would also be in the high hazard zone of such a spill. As for the infrastructure at risk, construction of the facility was made possible by $12.4 million in public financing, along with a massive private capital campaign to install advanced computer technology and equipment in the classrooms. Further, because of its unique location in Newport, one of the areas in which the college will be offering a course of studies is in the tourism and hospitality industry.

Signed under the penalties of perjury this day of August, 2005.

Evan Smith

Evan . Smith

State of Rhode Island
County of Providence

Subscribed and sworn to before me in the County of Newport,
State of Rhode Island on this 10 day of August, 2005.

Felecia A Fugere

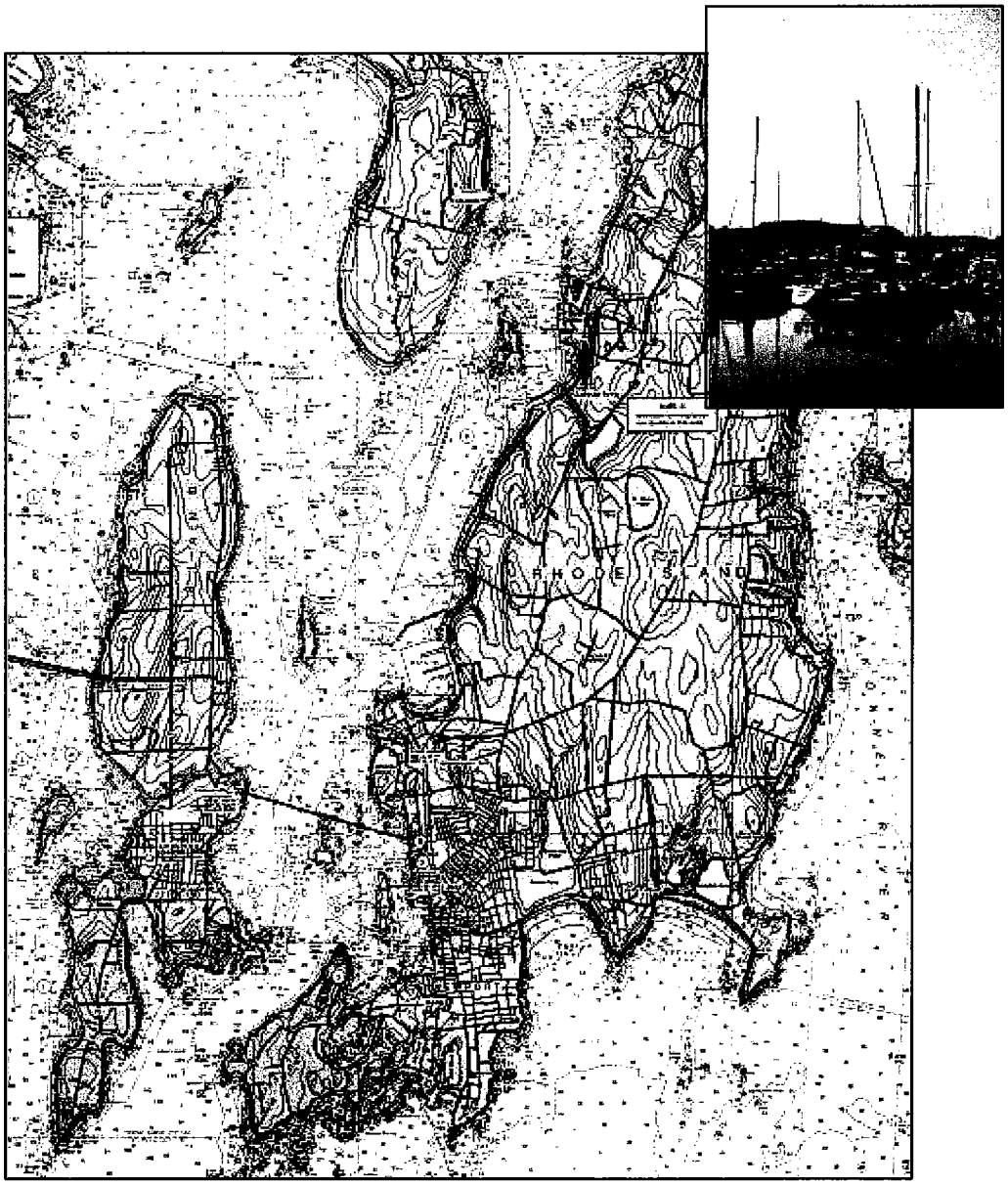
Notary Public
My Commission Expires on:

FELECIA G. FUGERE
NOTARY PUBLIC
STATE OF RHODE ISLAND
MY COMMISSION EXPIRES APRIL 20, 2006

LNG TANKER IMPACTS TO MARINE NAVIGATION

AQUIDNECK ISLAND

Newport, Middletown and Portsmouth, Rhode Island



Aquidneck Island Planning Commission

AUGUST 2005

Liquefied Natural Gas Tanker Traffic Impacts to Marine Navigation

Aquidneck Island
Newport, Middletown, and Portsmouth RI

August 16, 2005

Aquidneck Island Planning Commission
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Prepared by:

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Table of Contents

Table of Contents

Page Number

List of Figures

List of Tables

Table of Contents

Page Number

Exhibits

Section 1
Executive Summary

The Aquidneck Island Planning Commission has contracted for the following assessment of the impacts of proposed liquefied natural gas (LNG) tanker traffic on recreational and commercial boating on Narragansett and Mount Hope Bay waters off Aquidneck Island. The Aquidneck Island Planning Commission's goal is to provide information on potential impacts for its constituent communities on the bay: Newport, Middletown and Portsmouth.

The study addresses the proposed LNG tanker safety and security zone and its impact on access through local waters, compiles information on existing use of these waters, and demonstrates the importance of recreational and commercial boating to the economy of Island communities. This study does not address the safety concerns related to LNG tanker traffic, nor does it address vehicular traffic impacts, which are the subject of a separate Aquidneck Island Planning Commission study. Although the following analysis addresses selected economic impacts resulting from LNG tanker traffic, it is not intended to be a comprehensive analysis of each and every economic engine on Aquidneck Island.

Two LNG import terminal facilities have been considered for new or upgraded service in areas that could have a substantial impact on users of Narragansett and Mount Hope Bay:

- **Weaver's Cove Energy, L.L.C.** proposes new construction of an import terminal and natural gas pipeline facilities at Weaver's Cove, Fall River, MA. Federal Energy Regulatory Commission (FERC) approved this proposal on June 30, 2005. The applicant has prepared a Final Environmental Impact Statement (FEIS) / Environmental Impact Report in accordance with National Environmental Policy Act (NEPA)/ Massachusetts Environmental Policy Act requirements.

- **KeySpan LNG, L.P.** proposed upgrade of the existing terminal at Fields Point in Providence. This proposal was rejected by FERC on June 30, 2005, following the NEPA FEIS review process. Although this project was rejected, it has been included in the analysis pending any appeals.

Introduction of LNG tanker traffic to Narragansett Bay will impact the local economy and the way of life for Aquidneck Island residents and visitors alike. This activity will directly affect recreational and competitive sailing, tourism, high-end life style second home development, and the Naval Undersea Warfare Center (NUWC). These effects on the marine-dependent local economy will be felt throughout the state economy as well. The following list of LNG tanker transit operation requirements and considerations will assist the reader to better understand the scope of impacts to recreational and commercial boating:

- According to Weaver's Cove Energy, LNG tanker transit arrivals would not be routinely scheduled. Transit through the East Passage would not be announced prior to departure of the tanker from the Pilot Station in Rhode Island Sound. Recreational boaters have limited access to the US Coast Guard's Notice to Mariners and may not be tuned to VHF radio channels for information on LNG tanker transit. With one hour or less advance notice, it is not likely that many recreational boaters would be aware of a transit three or four miles to the south.

- According to Weaver's Cove Energy, LNG tankers bound for Fall River, MA would enter the East Passage of Narragansett Bay during any daylight hours, three hours before high tide. The outbound trip would also be planned to coincide with high tide in Fall River. Due to recent dredging of the Providence River channel, KeySpan LNG transit would not be tide-dependent and therefore would have less inconvenience to recreational boating with arrival and departure routinely scheduled at "first light."

- According to the Weaver's Cove Energy FEIS, the anticipated headway of an LNG tanker would be 10 knots south of Sandy Point, Prudence Island (west of Melville), and 5 knots north of Sandy Point through Mount Hope Bay. Transit time for an LNG tanker from the East Passage entrance to the Pell Bridge would be 23 minutes; between the Pell Bridge and Sandy Point transit would be 38 minutes; and between Sandy Point and the Braga Bridge, transit time would be an additional 103 minutes.

- LNG tanker safety and security zones extend two miles ahead, one mile behind, and 1,000 yards (3,000 feet) on either side of the ship. For a 920-foot tanker with a 150-foot width, this zone would encompass a water (and adjacent land) area 3.2 miles in length by 1.2 miles in width. Recreational and commercial boats would be prohibited from this zone without the permission of the US Coast Guard Captain of Port, Providence. This safety and security zone is in accordance with 33CFR 165.121 as specifically mandated for high-interest vessels (including LNG tankers) in Narragansett Bay and is NOT the reduced-width zone reported in the FEISs.

- As indicated in the FEISs prepared for both LNG projects, the safety and security zone would be enforced for both inbound and outbound LNG tankers. The Weaver's Cove Energy FEIS indicates that 50 to 70 LNG tankers are proposed annually initially; at least two transits would be made weekly, inbound and outbound. KeySpan has proposed 50 to 60 inbound tankers per year or one inbound and one outbound tanker transit every six to seven days.

- The US Coast Guard routinely coordinates shipping schedules to assure movement of commerce. The Captain of the Port coordinates with

shipping companies, ferry operators, cruise ship agents, regatta organizers, and the Northeast Marine Pilots Association to adjust schedules and avoid conflicts. Increased coordination would be required with proposed "high interest" LNG tankers. According to the US Coast Guard, LNG tankers so not have priority over other traffic.

Narragansett Bay is one of Rhode Island's primary economic assets. Its value to marine recreation, tourism and events, fisheries and aquaculture, boatbuilding, boating-related businesses, shipbuilding, marine transportation, military and marine research, technology and education have been well documented. The State of Rhode Island has advanced several recent initiatives to capitalize on the importance of the bay, not just on a quality of life basis for its residents, but also as a major economic driver. According to the *Narragansett Bay Summit 2000 Marine Recreation and Tourism White Paper*, the total annual value of Bay-related outdoor recreation activities is $2.0 billion.

Waters off Newport in the East Passage represent some of the most important recreational resources of Narragansett Bay. Although the East Passage represents a relatively small portion of the bay itself, prime sailing conditions and a protected harbor with full services and landside amenities have demonstrated that Newport is the focus of boating activity. According to the US Coast Guard Castle Hill Station, over two thirds of events on Narragansett Bay are scheduled in the waters off Newport.

Newport is recognized nationally and internationally as a world-class yachting center. The irregular and unannounced schedule of LNG tanker transit, together with delays to boating associated with passage of the LNG tanker safety and security zone, may affect the ability of Newport to retain a world-class image. Pleasure cruising, children's sailing lessons, the local Jamestown-Newport Ferry, tourist cruises, trips to Rose Island Light, and lifeline ferry service and emergency runs to Prudence and Hog Islands are among the many activities that could be delayed, especially during the peak summer boating season. With 30,000 registered boats in Rhode Island, 2,500 boats moored or at slips in the East Passage, and over 1,400 slips permitted but not yet constructed (see Section 3), potential conflicts on the waterways can be expected.

Imposed LNG tanker safety and security zones will dominate much of the East Passage, temporarily blocking recreational and commercial marine traffic from the entrance to the East Passage at Castle Hill to north of the Pell Bridge and then from Prudence Island north through the Mount Hope Bridge to Mount Hope Bay (see Figures 1 through 6). Minimum anticipated delays for inbound LNG tanker transit are presented in Table 1; similar delays would be anticipated for outbound LNG transit.

Table 1: LNG Inbound Transit Delay, East Passage Ports

Port	Destination	Minimum Delay
Newport	RI Sound, South	33 minutes
Newport	East Passage, North	18 minutes, then at 10 knots to rear of safety and security zone
Melville	RI Sound, South	Skirt to east shore
Melville	South of Prudence Island	25 minutes

Port	Destination	Minimum Delay
Melville	East Passage, North	18 minutes, then at 5 knots to rear of safety and security zone
Willow Lane (Proposed marina)	East Passage, South	36 minutes
Willow Lane	North to Mount Hope Bay	36 minutes then at 5 knots to rear of safety and security zone
Willow Lane	North of Prudence Island	36 minutes
Brewers Sakonnet Marina	West through Mount Hope Bridge	67 minute minimum

The LNG tanker safety and security zone would extend into Jamestown Harbor, an area where 400 boats are moored or at slips. Newport Harbor with over 900 boats moored or at slips, could be blocked for at least 20 minutes, the time it would take an inbound tanker safety and security zone to reach Fort Adams and clear Rose Island. This time period would increase depending on the number of boats blocked in the harbor, especially during peak recreational boating hours when boats from the East Passage would be diverted to Newport Harbor. This bottleneck would increase marine congestion within the harbor and lead to decreased safety, especially for less experienced boaters or those with non-motorized craft.

The only areas available for boaters to skirt the zone would be in the waters north of Gould Island between Jamestown and Prudence Island on the west or in waters south of Melville on the east shore. Waters on the west are currently restricted for use by Naval Undersea Warfare Center (NUWC) as a test range for experimental vessels. Restricted waters are also located in the vicinity of Coasters Harbor Island and Coddington Cove on the east. With the safety and security zone for proposed LNG tanker transit, what previously had been considered expansive waters of Narragansett Bay may now be significantly reduced for recreational mariners several times weekly during the boating season. As a result, the East Passage may be less attractive for recreation, with a new preference given to waters west of Jamestown and Prudence Island.

Of great economic impact would be the potential loss of Newport's ability to retain major regattas and events such as the Tall Ships that attract local, national and international participation. The effect of these events is significant not only to the local but to the state economy. For example, major regattas scheduled in Newport in 2005 include NYYC's 100th Annual Regatta, the Rolex Swan American Regatta, Grey Goose ISAF Team Racing World Championships, Black Duck Rum Classic Regatta, Farr 40 East Coast Championships, 26th Annual Classic Yacht Regatta, and the 12 Meter World Championships. With LNG tanker traffic and the limits it imposes, Newport may undergo a subtle shift in image from a sailing capital to a city on a busy commercial waterway.

LNG tanker transit may affect Newport's reputation as a tourist destination. The cruise ship industry could find Newport less attractive as unannounced LNG tanker safety and security zones may preclude use of the cruise ship mooring area west of Goat Island. Any inconvenience or negative experience with LNG tanker safety and security zones may lead cruise lines to abandon Newport in favor of other ports as destinations with more predictable access. With an average of 600 passengers per ship and 31 ships annually, the City of Newport collects approximately $75,000 in

landing fees. According to Evan Smith, CEO of the Newport County Convention and Visitors Bureau, the average cruise ship passenger spends $105 in Newport. Any diminution of the cruise ship trade would have a small but important impact on the local economy and the city budget.

According to *Rhode Island's Marine Tourism Economy* (draft, 2004) the Newport tourism industry generates $89.89 million in annual wages with $262.91 million in output (revenue). In Middletown the tourism industry generates $25.18 million in annual wages with $109.81 million in output. Any impact that reduces the attraction of Newport as a tourist destination would have a ripple effect in the island economy. Especially vulnerable is the high-end market with options on where to moor a boat, buy a second (or third) home, or spend a vacation. This market may choose other vacation destinations if Newport's sailing image is overshadowed by LNG tankers.

The impact of LNG tanker transit is important in Portsmouth where proposed high-end life-style residential development promises to yield $4 million annually in local property taxes (East Bay Newspapers, July 21, 2005). LNG tanker transit safety and security zones and delays associated with the commercial shipping holding area for the one-way pattern located off the shores of Carnegie Abbey could affect the full build-out potential of the O'Neill Properties Group $750 million developments proposed at Carnegie Abbey and at the 1,400-slip marina permitted at Portsmouth's Weaver Cove in Melville. Waters off Melville and Sandy Point on Prudence Island, extending north to the Mount Hope Bridge, will be especially congested as the LNG tanker slows to tether tug boats and maneuver to pass between piers of the Mount Hope Bridge. Delays for some boaters in this area could be double or more the FEIS-projected 36-minute delay based on the width of the zone and tanker speed. Delays and detours could adversely affect the ability of the Melville yachting center to attract and retain megayachts and other high-end sailboats.

LNG tanker transit through the East Passage could be in conflict with NUWC's ability to fulfill its mission to develop, test, and deliver viable undersea warfare weapon systems to the US Navy. Nearly 1.7 square miles of NUWC's exercise range (Restricted Area 334.80) is located within the proposed LNG tanker safety and security zone. NUWC estimates that five to seven events will be scheduled weekly on the range in 2006 and 2007 and that LNG tanker passage through the range would effectively halt any tests planned or in process. According to Donald Aker, NUWC Technical Manager, cancellation of a single event could result in a loss in excess of $50,000. NUWC and Naval Station Newport are major economic engines in the state. Any action that threatens the viability of NUWC to fulfill its mission could have far reaching implications not only to the local but also to the state and regional economy.

As evidenced by the data in the following report, the effect of unannounced LNG tanker transit, with its 3.2-mile long by 1.2-mile wide safety and security zone, will be of substantive impact on the economy of Newport, Aquidneck Island, and the state of Rhode Island. When combined with vehicular traffic impacts resulting from bridge closures and with the general anxiety associated with safety, LNG tanker transport has the potential to also affect the marine oriented way of life for residents of Aquidneck Island communities.

Section 2
LNG Tanker Safety and Security Zones

Following the events of September 11, 2001, the Code of Federal Regulations specifically established the dimensions of safety and security zones in Rhode Island waters. 33 CFR 165.121, Safety and Security Zones: High Interest Vessels, Narragansett Bay, Rhode Island, specifies that the zone applies to all high interest vessels transiting waters of Rhode Island Sound, Narragansett Bay, and the Providence and Taunton Rivers *two miles ahead and one mile astern, and extending 1,000 yards (3,000 feet) on either side.* The zone also applies within a half-mile radius of high interest vessels anchored in the Narragansett Bay Precautionary Area, located south of the entrance to the East Passage in Rhode Island Sound. High interest vessels operating within the Captain of the Port, Providence zone include the following: barges or ships carrying liquefied petroleum gas (LPG), liquefied natural gas (LNG), chlorine, anhydrous ammonia, or any other cargo deemed to be of high interest by the Captain of the Port, Providence. Entry into or movement within these zones, including below the surface of the water, during times in which high interest vessels are present and the zones are enforced, is prohibited unless authorized by the Captain of the Port, Providence or authorized representative. All persons and vessels shall comply with the instructions of the Captain of the Port and the designated on-site US Coast Guard personnel. On-scene Coast Guard patrol personnel include commissioned, warrant, and petty officers of the Coast Guard on board Coast Guard, Coast Guard Auxiliary, local, state and federal law enforcement vessels. (33 CFR 165.121)

Both the Weaver's Cove Energy and KeySpan LNG FEISs specify a safety and security zone that is two miles ahead, one mile behind, *but only 1,500 feet on either side of the LNG tanker.* This is not in compliance with 33 CFR 165.121 as cited above. The Weaver's Cove FEIS indicates the following: "Additionally it is important to note that the requirements of 33 CFR 165.121 were designed to apply to any high-interest vessel transiting Narragansett Bay and does not give consideration to safety or security measures that may be applied to mitigate risk. Considering the robust security plan that was devised during the Coast Guard-sponsored workshops, it is *likely* that LNG-specific security zone regulations will be promulgated." (WC FEIS 4-270, emphasis added). "A detailed security plan describing the resources and prevention/mitigation strategies *has been provided* to the FERC. The plan includes an offshore security sweep by a Coast Guard boarding team, aerial surveillance, and an escort to the dock by armed security boats to enforce a safety and security zone." (WC FEIS 4-269, emphasis added) Note that no change has been promulgated to date for the safety and security zone. In response to questions posed at an August 3, 2005 Newport City Council presentation, representatives of Weaver's Cove Energy did not present strategies, citing the need for security.

It is important to note the fact that the FEISs for both LNG facilities **consistently cite a safety and security zone that does not meet current federal regulation.** With a reduced safety and security zone width, the impact to recreational boating and navigation is significantly reduced compared to the federal regulation that mandates a 6,150-foot or 1.2-mile wide zone for a 150-foot wide tanker. The zone

indicated in the FEISs, for a maximum 142-foot wide tanker, would extend 3,142 feet, or 0.6 miles in width. By reducing this zone in half, the safety of boaters, residents, and visitors is potentially reduced. This is a critical point in the heavily plied waters off Newport between Castle Hill and the Pell Bridge where East Passage widths are less than the width of the federally mandated safety and security zone.

LNG tanker safety and security zones would dominate much of the East Passage, temporarily blocking recreational and commercial marine traffic from the entrance to the East Passage to the Pell Bridge and then from Prudence Island north through the Mount Hope Bridge to Mount Hope Bay. The only areas available to skirt the zone would be in the waters north and west of Gould Island between Jamestown and Prudence Island. These waters, however, may be restricted for use by the Naval Undersea Warfare Center (NUWC) as a test range for experimental vessels. Restricted waters are also located in the vicinity of Coasters Harbor Island and Coddington Cove. With the safety and security zone for proposed LNG tanker transit, what previously had been considered expansive waters of Narragansett Bay may now be significantly reduced for recreational mariners several times weekly. The East Passage may be avoided for recreation with a preference given to waters west of Jamestown and Prudence Island.

The length of the safety and security zone for a 930-foot LNG tanker is 3.2 miles (2.8 nautical miles). At 10 knots or 10 nautical miles per hour (estimated LNG tanker speed south of Sandy Point for Weaver's Cove Energy or through the East Passage for KeySpan), the LNG tanker safety and security zone would pass within 18 minutes. For an LNG tanker in transit at 5 knots (Sandy Point, Mount Hope Bridge, Mount Hope Bay bound for Weaver's Cove Energy), the safety and security zone would pass in 36 minutes. These minimum delays are cited in the FEISs. (WC FEIS 4-273) Actual delay would be longer, however, especially in areas where waters are less than 1.2 miles across.

LNG Tanker Transit

Weaver's Cove Energy, L.L.C. proposes new construction of an import terminal and natural gas pipeline facilities at Weaver's Cove, Fall River, MA. Based on key FEIS findings, presented in Appendix 1, between 50 and 70 LNG tankers would arrive at the Weaver's Cove Energy facility annually. It is assumed that during summer months the average arrival rate would be once every 7 days with winter deliveries once every 5 days. Safety and security zones could be required for both inbound **and** outbound LNG transit. Summer transit would therefore be twice per seven days with winter transit twice per five days (inbound and outbound trips). Inbound **and** outbound trips would be limited to rising tides (timed to minimize current effects in the area of the Brightman Street Bridge in Fall River/Somerset) during daylight hours, especially in initial operation. With shorter daylight hours in the winter and increased LNG trips, commercial fishermen and other commercial shipping would experience more disruptions than recreational boaters.

KeySpan LNG, L.P. proposes an upgrade of the existing terminal at Fields Point in Providence. Between 50 and 60 KeySpan deliveries were proposed annually (dropped from further consideration by FERC on June 30, 2005 but under appeal by

KeySpan). It is assumed that during summer months the average arrival rate would be once every seven days with winter deliveries once every six days. Transit to KeySpan in Providence would not be limited by tides. It is anticipated that the impact to recreational boating would be less than that anticipated for Weaver's Cove Energy since LNG transit would generally be scheduled at first light to avoid impacting local boating and other users of the bay.

Northeast Marine Pilots Association

The Northeast Marine Pilots Association (NMPA) provides pilots for most commercial vessels in Narragansett Bay. The pilots have not yet determined under what conditions the proposed LNG tankers could safely transit the bay. (H. McVay, 7/1/05) Before they will pilot a new LNG tanker (i.e., one which they have not previously piloted) through Narragansett Bay and to its port, numerous training simulations will be run for the particular ship involved and for many different weather, tide and power conditions. If pilots believe transit is unsafe for a particular ship or under certain conditions, the LNG tanker will not enter the bay.

The NMPA reports that ten or eleven LPG (liquefied petroleum gas) tankers are piloted annually through the bay to Providence. As a "high interest" vessel, the safety and security zone for LPG tankers is similar to one anticipated for LNG tanker transit, as determined by the US Coast Guard Captain of the Port. The pilots are not aware of negative impacts due to LPG tanker traffic. Prior to an LPG "gas ship" arrival, the US Coast Guard issues a Notice to Mariners to provide notification of the expected schedule. Commercial shipping and fishing operations adjust their schedules and locations accordingly, or move out of the way of the security zone when the ship comes through. Sail racing associations and yacht clubs generally call the NMPA for accurate estimated time of arrival for LPG tankers, and then schedule their events to avoid the ship passage, which is usually just a few minutes. The NMPA reports that there is far more tug and barge traffic (not piloted by the NMPA, or requiring security zones) that adversely affects sail racing/training and recreational boating than large tanker traffic.

Prior to entering US waters, the US Coast Guard inspects incoming tankers. Due to new legislation, prior to entering the bay an LNG tanker must have an LNG Certified American Master Mariner on board to inspect its cargo and safety systems. Following inspection, a Pilot would navigate the tanker into the bay and to its port. If, in the Pilot's judgment, conditions are not suitable for safe passage (e.g. severe weather), he/she will not take the LNG tanker in (this applies to any piloted ship, not just LNG tankers). The ship's Master can then decide whether to stay at sea, or to request to anchor at a designated anchorage in the bay.

Critical Issues of Concern

Several issues are critical to recreational boaters, especially with the tide-dependent schedule of Weaver's Cove Energy LNG tankers. Recreational boaters have limited access to the US Coast Guard's Notice to Mariners with information on LNG tanker transit. With one hour or less advance notice, it is not likely that many recreational boaters would be aware of a transit three or four miles to the south. Many recreational boaters do not routinely monitor marine band radios, especially the

channels the US Coast Guard will use for notification. As a result, they may be caught unaware of the moving picket and patrol boats. Patrol boats will be equipped with loudspeakers or bullhorns to announce the arrival of safety and security zone closure areas. (J. Duffy, 7/5/05) Joseph L. Duffy, Lieutenant Commander, US Coast Guard, retired has indicated, "The introduction of LNG supertankers into Narragansett Bay, particularly as accompanied by the required safety and security zone, will only further increase the congestion and heighten the considerable risk that already exists." (J. Duffy, 6/24/05)

In some areas of the East Passage and Mount Hope Bay, recreational boats, shallow draft fishing boats and ferries may skirt the safety and security zone by bypassing through shallower waters. It may be challenging, however, for sailboats without motors to skirt the security zone. Security zones will especially inconvenience these boats since mobility is limited by available wind.

Several sections of the East Passage and entrance to Mount Hope Bay are narrower than the 6,150-foot width of the safety and security zone. Marine commercial and recreational traffic would be halted in these areas, potentially creating congested waters. Figures 1 through 6 outline the LNG tanker route as it transits the East Passage and Mount Hope Bay for access to either Weaver's Cove Energy in Fall River or KeySpan in Providence. Typical safety and security zones are identified in a red hatch on each figure (two miles ahead, one mile behind and 3,000 feet off the port and starboard). This is a moving zone; the areas north and south of this zone are identified in a gray hatch. The graphic is based on a 930-foot tanker, 150-feet wide. The following describes critical areas where the 6,150-foot wide safety and security zone specified in 33 CFR 165.121 would affect local navigation.

Castle Hill, Newport - Beavertail Light, Jamestown to Gould Island

As indicated in Figures 1 and 2, the LNG tanker safety and security zone would effectively block access to the East Passage from Lion Head on the west to Castle Hill on the east. A boater returning to the East Passage from Rhode Island Sound would not be able to skirt an inbound LNG tanker safety and security zone between Lion Head and a point north of the Pell Bridge, a distance of 3.1 nautical miles. Note that rough waters south of Castle Hill are especially dangerous for small vessels. During this time a boater would be restricted to passage at 10 knots at the rear of the zone. Although many sailboats cruise below this speed, large powerboats routinely exceed this speed and would be constrained.

Southbound boaters on the East Passage could seek refuge from the inbound LNG tanker safety and security zone in Newport Harbor (east of Fort Adams and Rose Island) or in Potter Cove, north of the Pell Bridge off Jamestown. The LNG tanker safety and security zone would extend into Jamestown Harbor, an area where the Jamestown harbormaster reports that 400 boats are moored or at slips. A minimum delay of 33 minutes would be anticipated to clear the zone between Castle Hill and Fort Adams.

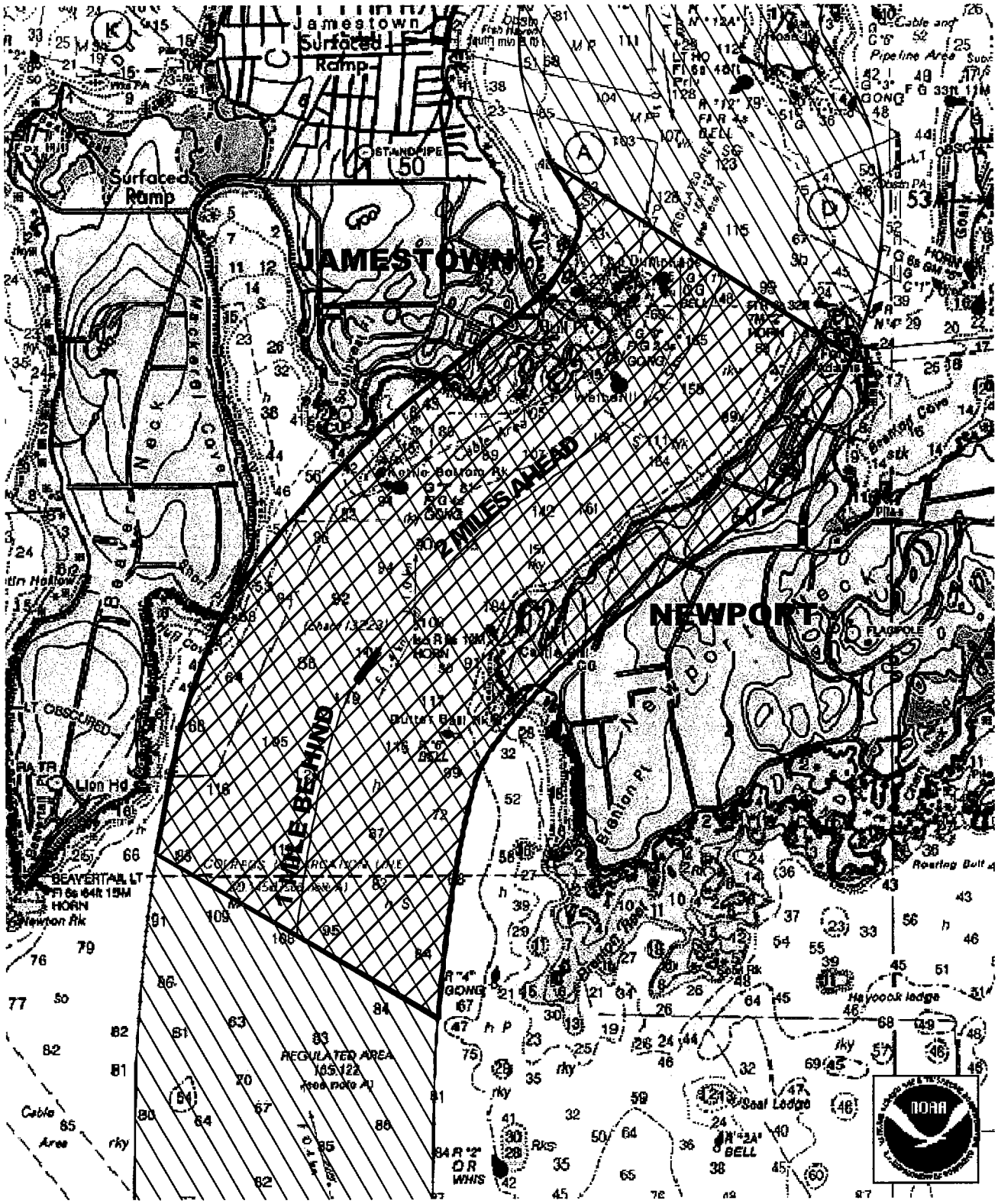


FIGURE 1 - CASTLE HILL
LNG TANKER SAFETY & SECURITY ZONE

WEAVER'S COVE ENERGY, LLC & KEYSPAN LNG TANKER ROUTE

LNG MARINE IMPACTS - AQUIDNECK ISLAND

SCALE: 1"=3000'

DATE: AUGUST 2005

LEGEND

- LNG TRANSIT ROUTE
- TYPICAL LNG TANKER SAFETY & SECURITY ZONE
- LNG TANKER

PARE

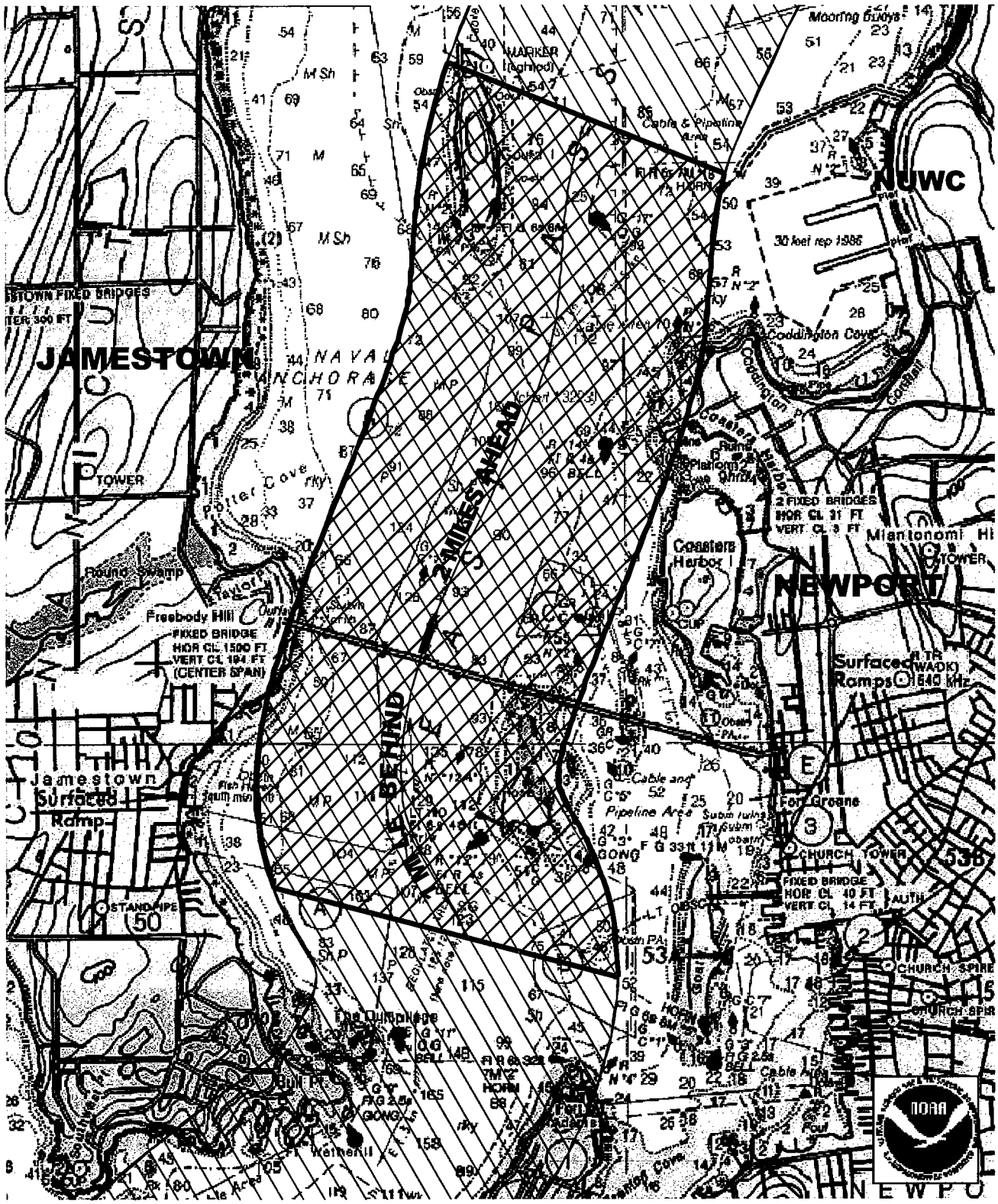


FIGURE 2 - NEWPORT

LNG TANKER SAFETY & SECURITY ZONE

WEAVER'S COVE ENERGY, LLC & KEYSPAN LNG TANKER ROUTE

LNG MARINE IMPACTS - AQUIDNECK ISLAND

SCALE: 1"=3000'

DATE: AUGUST 2005

LEGEND

- LNG TRANSIT ROUTE
- TYPICAL LNG TANKER SAFETY & SECURITY ZONE
- LNG TANKER

PARE

Newport Harbor with over 900 boats reported by the Newport harbormaster to be moored or at slips, could be completely blocked for at least 20 minutes, the time it would take an inbound tanker safety and security zone to reach Fort Adams and clear Rose Island. This time period would increase depending on the number of boats blocked in the harbor. The delay would likely be longer, especially during peak recreational boating hours. This bottleneck would increase marine congestion within the harbor and lead to decreased safety, especially for less experienced boaters or those with non-motorized craft.

The commercial mooring area north of the Pell Bridge along the Jamestown shore (identified on the NOAA chart as Naval Anchorage A) is currently used to off-load oil tankers to smaller vessels. This mooring area is partially located within the LNG tanker safety and security zone, as indicated in Figure 2. Upon completion of the US Army Corps of Engineers Providence River Dredge Project in 2005 off-loading may be required less frequently. The Corps has indicated, however, that it may not be able to achieve full project dimensions throughout the river due to ledge that was encountered during dredge operations. The Corps is now working on a project to remove these obstructions. The US Coast Guard and Pilots may determine that mooring or off-loading is still required, depending on draft of the vessel and determinations of safe passage. (S. DiLorenzo, 8/9/05) The US Coast Guard would likely prohibit use of this mooring area to off-load oil tankers during LNG transit, thereby eliminating the potential for conflicts between recreational boaters and off-loading tankers as boaters skirt the zone.

Once the safety and security zone passes north of Rose Island, Newport Harbor boaters would have access southward to Rhode Island Sound and offshore destinations. For boaters with destinations north via the East Passage, however, speed would be restricted to 10 knots between Newport Harbor and Green Can "13," north of the Pell Bridge. From this point, boats would have access to waters west of Gould Island (assuming the NUWC is not conducting exercises). It is noted that boaters are prohibited from entering waters around Coasters Harbor Island on the east shore due to Naval Station Newport security restrictions.

Prudence Island to Mount Hope Bridge

As indicated in Figures 3 and 4, the LNG tanker safety and security zone favors the Prudence Island shore, prohibiting movement to or from the Town of Portsmouth pier at Sandy Point and private docks and moorings along the Island's east shore. Waters to the east of Dyer Island, off Melville, would be available to skirt the LNG tanker safety and security zone. Melville is the boating center of northern Aquidneck Island and includes the 100-boat Hinkley Yacht Center, 500-boat East Passage Yachting Center, and other marine industries. Many of the largest sailboats on the East Passage have slips in this area. In addition, a 1,400-boat marina is permitted in Portsmouth's Weaver Cove, immediately south of Melville. Any diversion of East Passage boating traffic to the waters off Melville would create congestion and lead to decreased marine safety.

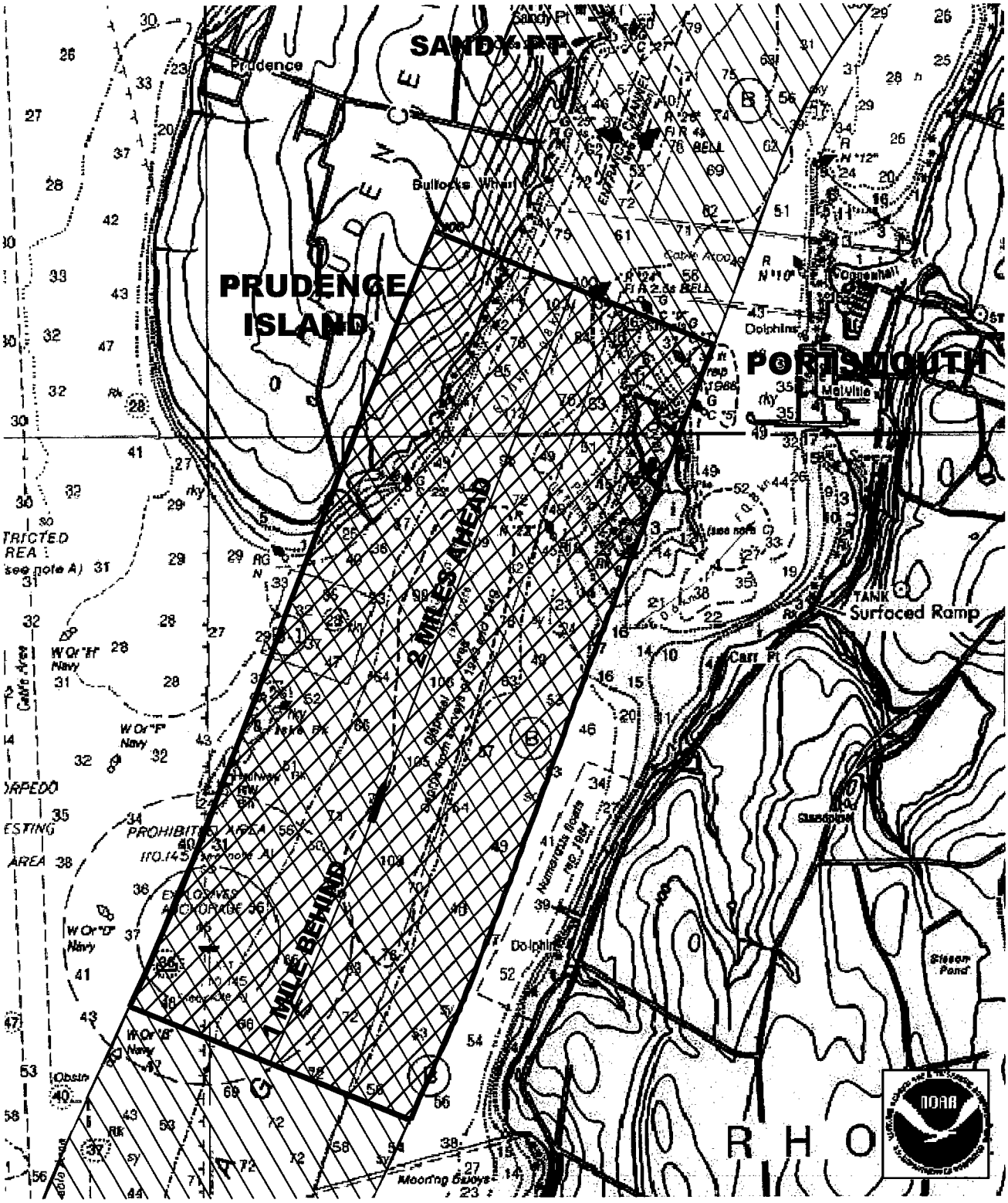


FIGURE 3 - MELVILLE

LNG TANKER SAFETY & SECURITY ZONE

WEAVER'S COVE ENERGY, LLC & KEYSPAN LNG TANKER ROUTE

LNG MARINE IMPACTS - AQUIDNECK ISLAND

SCALE: 1"=3000'

DATE: AUGUST 2005

LEGEND

- LNG TRANSIT ROUTE
- TYPICAL LNG TANKER SAFETY & SECURITY ZONE
- LNG TANKER

PARE

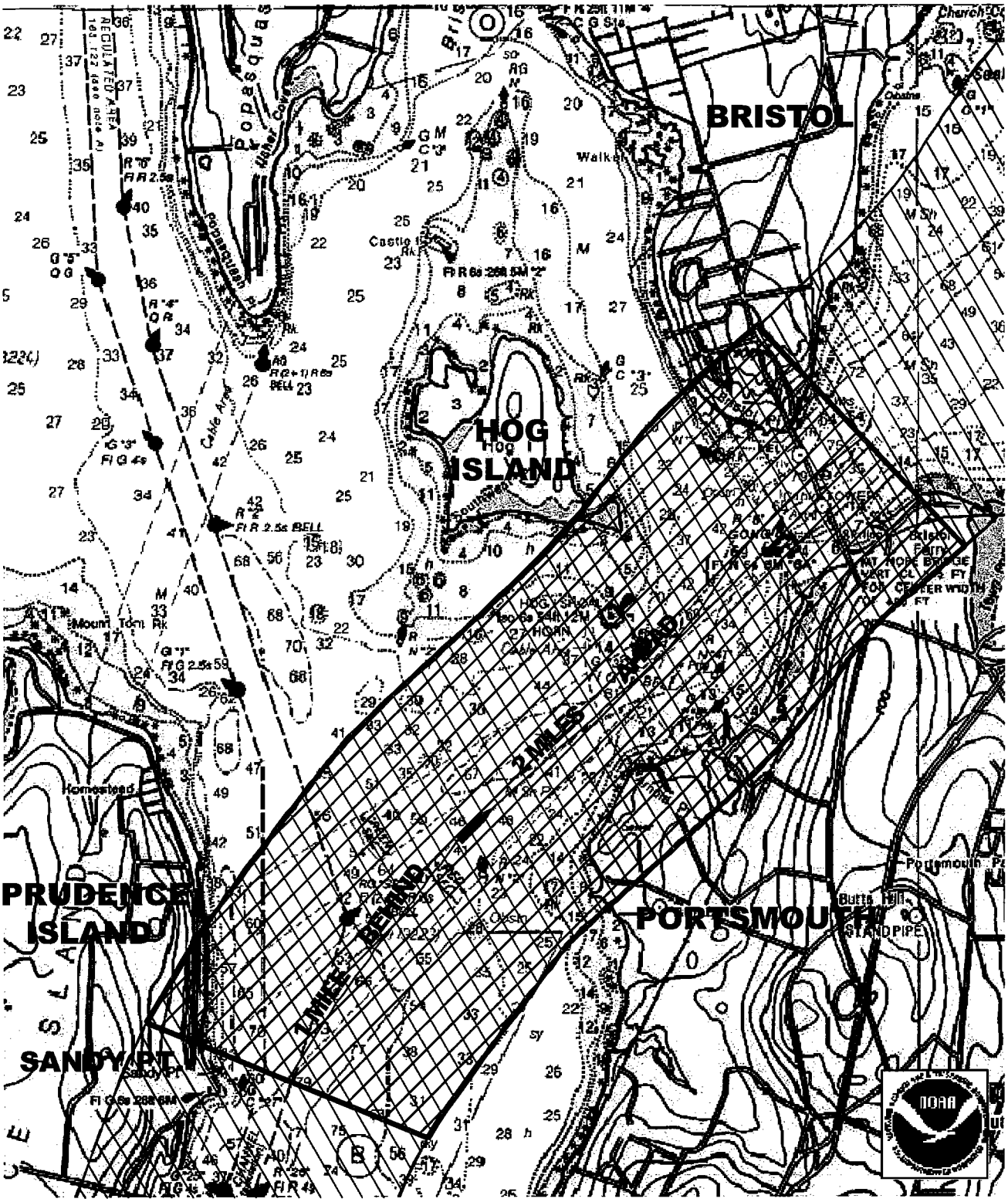


FIGURE 4 - MT. HOPE BRIDGE

LNG TANKER SAFETY & SECURITY ZONE

WEAVER'S COVE ENERGY, LLC

LNG MARINE IMPACTS - AQUIDNECK ISLAND

PARE

SCALE: 1"=3000'

DATE: AUGUST 2005

LEGEND

- LNG TRANSIT ROUTE
- TYPICAL LNG TANKER SAFETY & SECURITY ZONE
- LNG TANKER

Many Melville and Weaver Cove boats would be able to skirt the safety zone along the east side of the East Passage. Boats bound for waters south and west of Prudence Island would be delayed a minimum of 25 minutes as the LNG tanker safety and security zone enters a point between Halfway Rock south of Prudence Island and the former Navy Midway Pier near Greene Lane in Middletown and clears Melville. LNG tankers bound for either Providence or Fall River would slow off Sandy Point to accept tethers from tug boats. Fall River-bound LNG tankers would slow to 5 knots to navigate the channel between Hog Island and Portsmouth and pass between the piers on the Mount Hope Bridge. All northbound boating traffic would be limited to 5 knots in the area north of Sandy Point as the Weaver's Cove Energy LNG tanker safety and security zone extends from shore to shore. Northbound KeySpan LNG tanker traffic would proceed at 10 knots on a northwestward course, as indicated in Figure 6.

The area north of Sandy Point and west of the Mount Hope Bridge would serve as a holding area for the one-way commercial traffic patterns that the US Coast Guard would impose on the Federal Channels to Providence and Fall River (see Appendix 1). Northbound commercial traffic (including oil tankers and coal barges) would be held in this area during outbound LNG transit from the Federal Channels. LNG tankers could also be held in these waters while other commercial cargo vessels are outbound from Providence or Fall River. Although not specified in 33 CFR 165.121, the safety and security zone would likely extend from a moored LNG tanker between 1,000 feet (as specified for a mooring at a waterfront facility) and a half-mile (as specified for a mooring in the Narragansett Precautionary Area in Rhode Island Sound).

As indicated in Figure 4, the LNG tanker safety and security zone for tankers bound for Weaver's Cove Energy extends into the area proposed for the 65-slip Carnegie Marina at the end of Willow Lane in Portsmouth. No movement would be permitted for the 36 minute minimum time it would take the reduced speed LNG tanker safety and security zone to clear this point and enable access south on the East Passage, west to waters between Prudence and Hog Islands or north to Mount Hope Bridge. Transit beneath the bridge would be limited to 5 knots at the rear of the safety and security zone. A similar delay would be anticipated for commercial shipping at the Mount Hope Marine Terminal in Portsmouth. Passage east and west of Hog Island from the south could be blocked at the same time by the Weaver's Cove LNG tanker safety and security zone.

Mount Hope Bay

Access from Mount Hope Bay (including boats from Brewer's Sakonnet Marina) to the East Passage could be restricted over an hour (67 minute minimum) as the LNG tanker safety and security zone passes northward from the Mount Hope Bridge to a point between Hope Point in Bristol and Common Fence Point in Portsmouth. See Figure 5. As the safety and security zone progresses northward through Mount Hope Bay, pleasure boats would be diverted to the north and south.

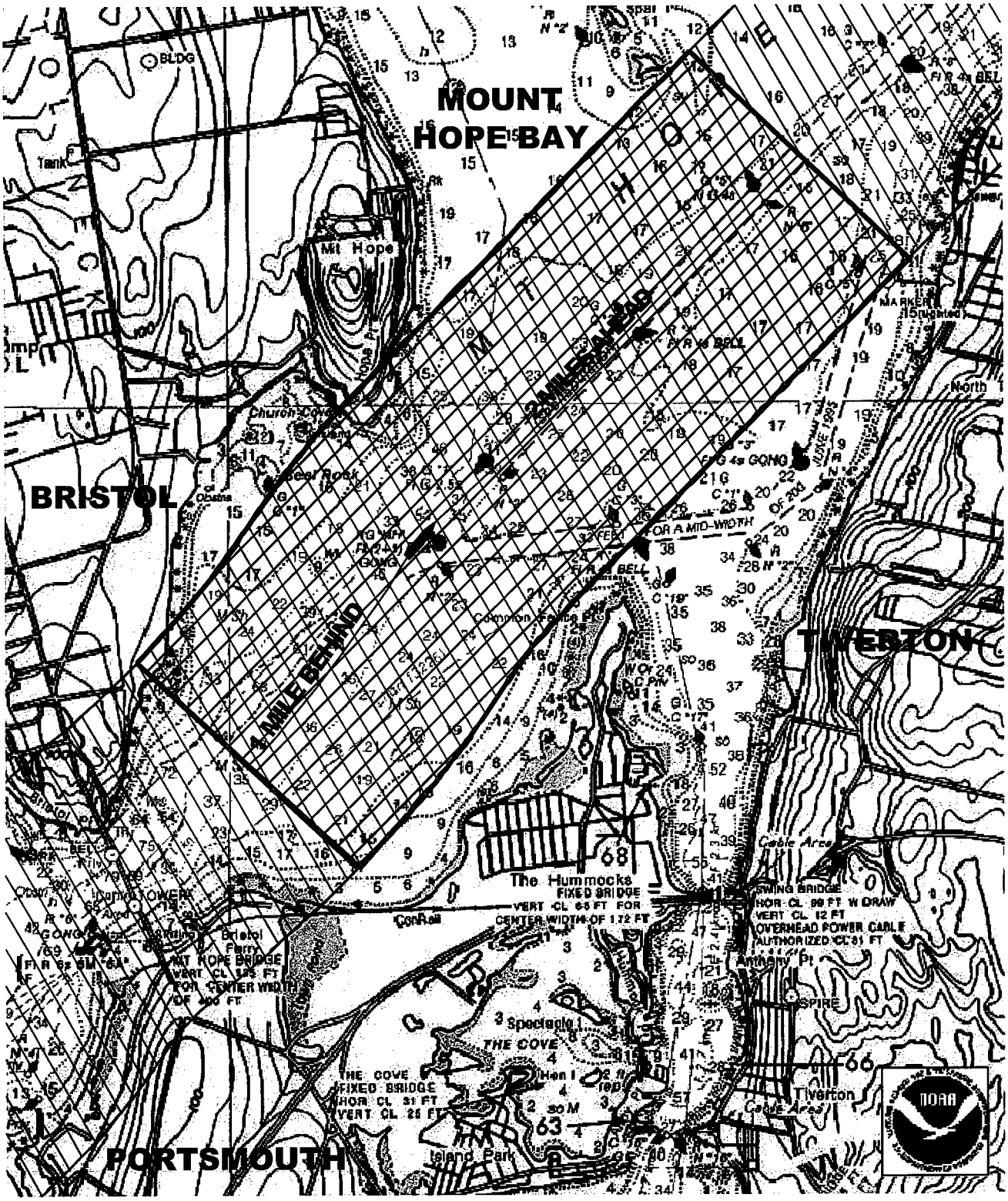


FIGURE 5 - MT. HOPE BAY
LNG TANKER SAFETY & SECURITY ZONE

LEGEND

- LNG TRANSIT ROUTE
- TYPICAL LNG TANKER SAFETY & SECURITY ZONE
- LNG TANKER

WEAVER'S COVE ENERGY, LLC TANKER ROUTE
LNG MARINE IMPACTS - AQUIDNECK ISLAND

SCALE: 1"=3000'
DATE: AUGUST 2005

PARE

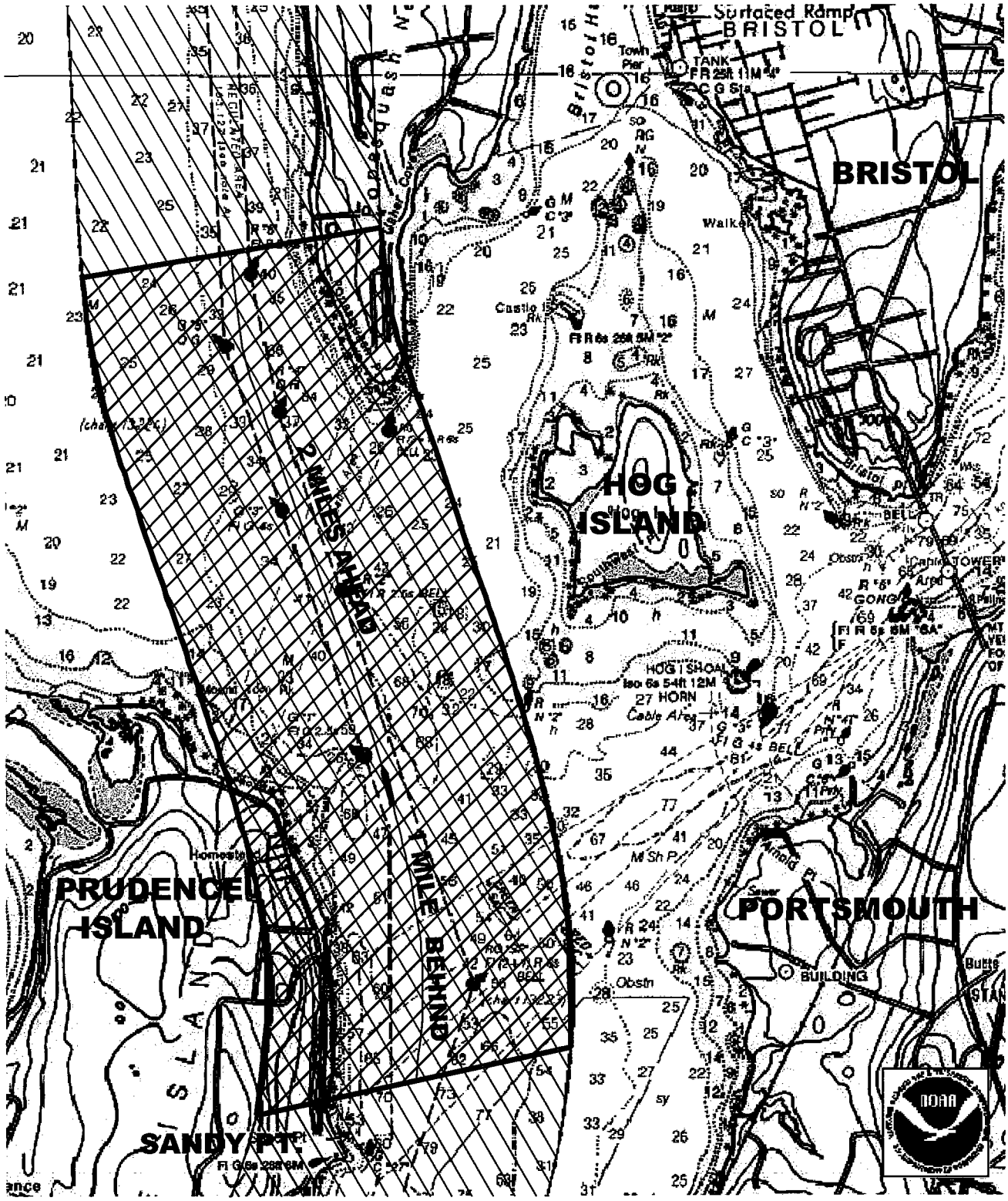


FIGURE 6 - HOMESTEAD

LNG TANKER SAFETY & SECURITY ZONE

KEYSPAN LNG TANKER ROUTE

LNG MARINE IMPACTS - AQUIDNECK ISLAND

SCALE: 1"=3000'

DATE: AUGUST 2005

LEGEND

- LNG TRANSIT ROUTE
- TYPICAL LNG TANKER SAFETY & SECURITY ZONE
- LNG TANKER

PARE

Many boaters would use the Sakonnet River to bypass the closure area and gain access to open waters of Rhode Island Sound. The Sakonnet River, especially the confined "basin" between the Sakonnet River Bridge and the old stone bridge, is known for its tidal currents that are especially strong in the hours preceding and following high and low tide. It is likely that boats would be diverted to the Sakonnet River in the hour preceding high tide, a time when tidal currents in the river are challenging (based on LNG tanker arrival in the Taunton River at high tide).

Weaver's Cove Energy has projected operation by mid-2009. The Rhode Island Department of Transportation's upcoming replacement of the Sakonnet River Bridge may be underway concurrently with LNG tanker transit. Transport of construction materials by barge could be subject to similar delays of over an hour when transiting the Mount Hope Bridge to Common Fence Point area. Increased boating volume in the Sakonnet "basin," especially with access restrictions required for bridge construction, could adversely affect boater safety in this narrow river channel.

Similar delays to those outlined above for inbound LNG tanker transit would be expected for outbound transit from Weaver's Cove Energy since departures would be tidally influenced and be conducted during daylight hours (and not necessarily at "first light."). Recreational and commercial boating will therefore be subject to the same delays and detours at least twice weekly.

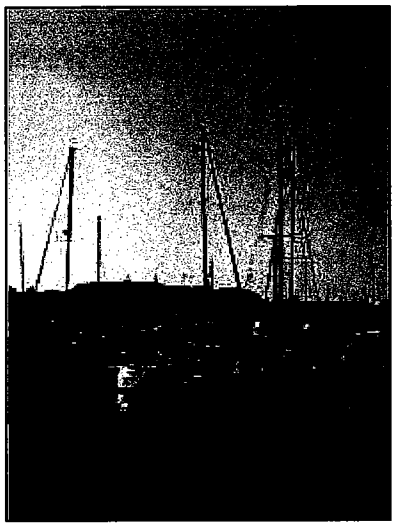
Nighttime Transit Issues

The Weaver's Cove Energy LNG FEIS indicates that nighttime transit of LNG tankers may be considered in the future to avoid impacts to recreational boaters. Nighttime transit of "high interest" vessels is currently prohibited by the US Coast Guard based on restricted visibility (E. LeBlanc, 8/12/05). Nighttime transit could raise additional security concerns for Aquidneck Island residents.

Section 3
Existing Marine Use

Section 3 presents information on current recreational and commercial use of the East Passage of Narragansett Bay. Impacts to marine use are presented in Section 4. This assessment does not include commercial traffic such as tankers, coal ships, LPG tankers, car carriers, passenger/cruise ships, and general cargo destined for ports in Providence, Quonset or Fall River. Impact to commercial traffic bound for those ports is addressed in the FEISs prepared for the two LNG facilities.

The documentation of existing marine use is limited to recreational boating, commercial marine use based in or operating to Newport, and operations at the Naval Underwater Warfare Center (NUWC). This section documents marine-related use in Newport and Portsmouth, from the East Passage entrance of Narragansett Bay at Brenton Point in Newport, northward along the Newport, Middletown, and Portsmouth shorelines to Mount Hope Bay. Note that Middletown, although it has shoreline along the East Passage of Narragansett Bay, does not have public shoreline access.



Recreational Boating

Marinas and Yacht Clubs

Newport Harbor is one of the most popular centers for recreational boating in Narragansett Bay. Recreational boating facilities include moorings and slips at private yacht clubs and marinas, transient moorings, and boat ramps. Landside support facilities provide fuel, service, pump outs, related locker rooms / laundry, and other services. Recreational boaters also support the local economy by purchasing supplies and patronizing local shops and restaurants.

Although the LNG Tanker Safety and Security Zone would not extend into Newport Harbor (see Figure 2), the 938 boats at slips and moorings routinely utilize the East Passage for access to Rhode Island Sound and Narragansett Bay destinations (T. Mills, 6/20/05). Approximately one third of the moorings are transient, available on a short term basis for those sailing, yachting, or cruising from other locations. Newport is a popular East Coast destination, world renowned for steady breezes, open water, local destinations, and yachting camaraderie and support. Oldport Marine reports that between 500 and 1000 boats can come and go on a busy summer day in Newport Harbor. (B. Hoffman, 7/14/05)

Yacht clubs located in Newport Harbor include the Ida Lewis Yacht Club (ILYC), the New York Yacht Club (NYYC), and the Newport Yacht Club. Coasters Harbor Yacht Club, located at Naval Station Newport, provides sailing programs and events north of the Pell Bridge. NYYC and ILYC 2005 events are listed in Tables 2 and 3. As indicated, international competitors are anticipated at these events.

Table 2: New York Yacht Club Major Events, 2005

Event	Date
NYYC's 100th Annual Regatta	July 12 103 Yachts
Rolex Swan American Regatta	July 25-29 Over 50 Swan Yachts, from 35 to 80 ft, Newport Shipyard
Morgan Cup	August 6 to 7
Grey Goose ISAF Team Racing World Championships	Sep 24-Oct 1 20 Teams from 12 countries, team = 3 boats

Source: http://nyyc.org

Table 3: Ida Lewis Yacht Club Events, 2005

Event	Date
Shields Wednesday Night Racing Begins	May 11
J24 Thursday Night Racing Begins	May 12
110 Friday Night Racing Series	May 20–September 2
10th Annual US Jr. Women's Dbl-Handed Championship	July 8-10
Conanicut Gull Cup, J22	July 23
Farr 40 Racing	September 10-11

Marinas listed by www.rimarinas.com include those listed in Table 4. In addition to the 938 moorings and slips reported by the harbormaster for Newport Harbor, over 1000 slips and moorings are identified in Portsmouth and nearly 400 are reported by the Jamestown harbormaster in Jamestown Harbor.

Table 4: Newport, Jamestown, and Portsmouth Marinas

Marina Name	Description
Newport	
Bannister's Wharf	24 boat slips for transients, gas, diesel, showers. Located in center of Newport.
Brown & Howard Wharf Marina	Ch 9.
Casey's Marina & Boat Hauling Service	Seasonal and transient dockage available.
Christy's Restaurant & Marina	40 transient boat slips.
Coasters Harbor Navy Yacht Club	
Goat Island Marina	200 boat slips and 10 transient slips, pool and showers. Ch 9.
Goat Island Yacht Club	
Ida Lewis Yacht Club	
Long Wharf Charters	
NETC Navy Marina	160 boat slips and 27 moorings available. A full facility yacht club.
Newport Harbor Hotel & Marina	70 transient slips, pool, showers, sauna. Popular boating location. Ch 9.
Newport Marina	45 slips, pool, showers, laundry and gas grill.
Newport Mooring Service	10 slips.
Newport Yachting Center	200 boat slips and a 2500 ft. dock, gas and diesel and laundry. Ch 9.

Marina Name	Description
Newport Yacht Club	
Newport Shipyard	Deep water dockage is available. Ch 9.
New York Yacht Club	
On-Shore Marina	
West Wind Marina	75 boat slips, a laundry and a restaurant.
Wellington Marina	
Wellington Yacht & Racquet	
Portsmouth	
Hinkley Yacht Services - Melville	100 deep water boat slips, 10 moorings, showers, gas, diesel and full services.
East Passage Yachting Center -Melville	500 boat slips, gas, diesel, pool, showers, playground, pump-out, full services. Ch 9.
Brewer's Sakonnet Marina N & S – Sakonnet River	330 boat slips, gas, diesel, pool, showers and full services. Ch 9.
Pirate Cove Marina – Sakonnet River	82 boat slips, 41 moorings, diesel fuel, ship's store, no launch, full services. Usually can find space for transient boaters. Ch 9.
Stone Bridge Marina – Sakonnet River	
Jamestown	
Conanicut Marina	Full services including a ship's store are available as well as 100 boat slips and 205 moorings with 6 slips reserved for transient boaters. Ch 71.
Conanicut Yacht Club	
Jamestown Boat Yard	Full services and marina including 6 boat slips, 1 reserved for transients, 57 moorings with 6 reserved for transients with launch services. Great location for fast in/out. Ch 72.
Jamestown Yacht Club	

Source: www.rimarinas.com. See the website for information on yacht clubs and other marine facilities not listed above.

Sailing programs are conducted by Sail Newport, J World, and Newport Off Shore. Sailing lessons are for all ages and abilities. See Table 5, below, for listing of Sail Newport sailing programs.

Boat Counts

Boat counts were conducted during a weekday and weekend period to document use of the East Passage for recreational and commercial boating. Weekday counts were scheduled to observe commercial fishing boats and general recreational use. Weekend counts were scheduled to observe typical summer recreational use. Counts were conducted at Fort Adams, Pell Bridge, and Melville to document use along the length of Aquidneck Island. Both the weekday and weekend counts were conducted during hot and clear early summer weather. A total of 129 boats were observed during the weekday count conducted between 5:45 AM to 1:45 PM on Friday, June 24, 2005. A total of 565 boats were observed on Saturday, June 25, 2005 between 10:00 AM and 5:15 PM. See Appendix 2 for more detail.

Regattas and Sailing Events

Many local, national, and international competitive events are held on the East Passage and Rhode Island Sound waters off Newport. Sail Newport, one of the primary organizers of boating events in the area, has indicated that events are planned every weekend and every weeknight from June 1 through September 15. Many events require crossing the deepest portion of the East Passage (although not designated as the federal channel, waters with the deepest depths are routinely utilized for shipping). Weekday night events may have as few as 30 boats to as many as 120. Larger weekend events attract approximately 350 to 400 boats daily. (B. Reed, 6/27/05) A listing of 2005 Sail Newport events is presented in Table 5.

Table 5: Sail Newport Events, 2005

Event	Date
OPTI Spring Series	Saturdays and Sundays, May 14 – June
Match Race Series	Every Monday starting May 9, Championship Weekend Oct. 8-9, 12 teams max
Memorial Day Regatta	May 28
One Week Keelboat Sessions	Weekly through summer Mon-Fri, ages 12-17
C420 Race Program	Tues, Wed, Thurs
Optimistic Race Program	Tues, Wed, Thurs, June 21 to August 11
2 Week Dinghy Sessions	Monday-Fri throughout summer minimum age-7
Jimmy Fund Regatta	June 4-5 35 yachts competed on the first day
OPTI Challenge	June 11-12 60 sailors competed in four races each day International and local competitors
Little Guppies Session	Aug 15-19, ages 5-7
Brooke Gonzalez Advanced Racing Clinic	June 17-19 18 Laser Radial's, 31 420's, 14 Laser Full Rig's
Black Duck Rum Classic Regatta	June 25-26 Event for classic Yacht owners, designed built before 1965, race and party
Newport Cup Around the Island	July 2
10th Annual US Jr. Women's Dbl-Handed Championship	July 8-10
Wall St. Corporate Challenge	July 8-9 6 Vintage America's Cup 12 Meter Yachts
Volkswagen Newport Regatta	July 16-17 Largest event in regatta history, over 300 boats, 14 states & 4 countries
N.E. Solo Twin Championship	July 29-30
Buzzards Bay Regatta	Aug 5-7
NBYA Jr. Race Week and Jr. Olympic Sailing Festival	Aug 16-18
C. Thomas Clagett, Jr. Memorial Clinic and Regatta	Aug 18-21
Sail Newport Blind National Championships	Aug 25-26
Farr 40 East Coast Championships	Aug 26-28

Event	Date
2005 Annual Unlimited Regatta	Aug 27-28
26th Annual Classic Yacht Regatta and Parade	Sept 2-4
CYC Around the Island Race	Sept 4
12 Meter World Championship	Sep 15-18
ISAF Team Race Worlds	Sep 24- Oct 1
Sail for Hope	Oct 1 73 boats, 400 sailors from 5 states, $25,000 raised

Public Boat Ramps

Three public boat ramps provide access to Newport Harbor for day use. Fort Adams State Park offers paved boat ramps and adjacent paved parking for trailers. This facility is well used and well known. The City of Newport boat ramp at King's Park, on Wellington Avenue has shallow draft and limited parking. Public access to the water is also available at Elm Street in the Point neighborhood. Only on-road residential sticker parking is available.

The Town of Porstmouth owns the Weaver Cove boat ramp south of Melville. This paved ramp, located on Burma Road, includes a floating pier and adjacent parking.

Permitted Marinas

A 1,400-slip marina has been permitted by CRMC immediately south of Melville, at Portsmouth's Weaver Cove. This marina is proposed to be constructed by the O'Neill Properties Group as part of a mixed-use upscale development.

CRMC and the US Army Corps of Engineers are currently reviewing permit applications for O'Neill Properties Group's 65-slip inland marina proposed on Willow Lane in Portsmouth. Carnegie Harbor Village Marina will include a 16-foot wide concrete public boat launch and a public parking area with 27 spaces (including eight for trailers). Public access paths are also proposed. This marina will serve high-end seasonal residential units under construction, including 80 units at Carnegie Tower and 21 separate village cottages.

US Coast Guard

Any event that will, by its nature, introduce extra or unusual hazards to the safety of life on the navigable waters of the U.S. must obtain a permit from the US Coast Guard Marine Safety Office in accordance with 33 CFR 100. Table 6 lists 2004 and 2005 marine events for which the US Coast Guard issued a permit through the Castle Hill Station. Although this list includes events throughout Narragansett Bay, it is interesting to note that approximately two thirds of all bay events are associated with Newport and adjacent waters.

Table 6: US Coast Guard Permits, Castle Hill Station, 2004 - 2005

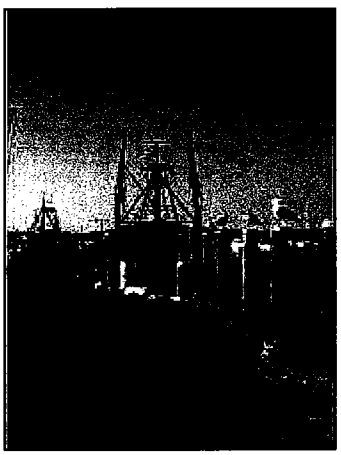
Event	Date
2004	
Newport Memorial Day Regatta	**29-30 May**
Optimist Youth Sail Challenge, Newport	**5-6 June**
Gaspee Days Fireworks, Warwick	11 June
NYYC 150th Annual Regatta	**11-13 June**
Newport-Bermuda Race	**18 June**
RI National Guard Air Show	18-20 June
UBS America's Cup Trial, Newport	**18-26 June**
Blue Parrot Yacht Club Blessing of the Fleet	27 June
Cardi Family Cookout Fireworks *	3 July
Warwick 4 July Fireworks *	3 July (5 July rain date)
N. Kingstown 4th of July Fireworks *	4 July
Annual Newport Regatta	**9-11 July**
Outerlimits Annual Regatta	10 July
Toyota/Sea Doo U.S. Regional Championships	**10-11 July**
Tall Ships Rhode Island	**15-20 July**
Tall Ships/Black Ships Fireworks *	**18 July**
NYYC Race Week	**16-25 July**
Newport Bucket Regatta	**24-25 July**
Save the Bay Swim, Newport	**24 July**
NYYC Annual Cruise	**31 July to 07 Aug**
National Night Out Fireworks, Warwick*	3 Aug
Opti New England Championship, Newport	**10-12 Aug**
Fall River Celebrates America Fireworks *	07 Aug
Telesmanick Regatta	14-15 Aug
NBYA Junior Race Week	16-18 Aug
Sail Newport Blind National Championship	**19-20 Aug**
Ensign National Championship, Newport	**23-26 Aug**
Newport Salute to Summer Fireworks *	**3 Sep**
25th Annual Classic Yacht Regatta	**4-5 Sep**
Hospice Regatta	11 Sep
Int'l Twelve Meter Class Champs	**16-19 Sep**
Int'l C Class Catamaran Champs.	15-26 Sep
Sail For Hope Regatta	**2 Oct**
2005	
Newport Memorial Day Regatta	**28 May**
Jimmy Fund Regatta	**4-5 June**
Wickford Y.C. Summer Race Series	8 June – 31 Aug (Wednesdays)
Annapolis to Newport Race	**10 June**
Gaspee Fireworks *	10 June
NYYC Annual Regatta	**10-12 June**
Optimist Youth Sail Challenge, Newport	**11-12 June**
RI ANG Air Show	17-19 June
NBYA Macadamia Nut Cup	18 June
NAVSTA Newport Fireworks *	**1 July**
Newport Fireworks *	**3 July**
Cardi Family Private Fireworks *	3 July
Warwick Fireworks *	3 July
Newport Bucket Regatta	**15-17 July**
Annual Newport Regatta	**15-17 July**

Event	Date
Toyota / Sea Doo Regional Championship	**16-17 July**
NYYC 100th Anniversary Vintage Regatta	**16-17 July**
NBYA Ice Cream Cone Cup	23 July
Rolex Swan American Regatta	**23-29 July**
Save the Bay Swim, Newport	**30 July**
OPTI New England Championships	**2-4 August**
Laser Regatta	**6-13 August**
Fall River Celebrates America Fireworks *	13 August
NBYA Junior Race Week	16-18 August
Blind National Championships	**25-26 August**
Farr 40 East Coast Championships	26-28 August
NBYA Herreshoff Regatta	27-28 August
NYYC 12 Meter Worlds	**14-18 September**
NYYC Grey Goose Champs	**24 Sep – 1 Oct**
Sail For Hope Regatta	**1 October**

***Bold** denotes location in East Passage*
** Fireworks launched from a waterborne platform or barge requires a permit.*
Source: US Coast Guard MSO Providence

Commercial Marine Use

Fishing Fleet



State Pier 9 in Newport is home to 50 commercial fishing boats, both inshore lobster boats and offshore draggers. This is the only state-owned commercial pier in the Newport area. The finfish and lobster industry in Rhode Island - from both Newport and Galilee - is about $70 million a year, according to 1997 and 1998 figures from the National Marine Fisheries Service.

Ferry Service

Several ferries provide seasonal service to Newport Harbor destinations. RIPTA's Providence to Newport high-speed ferry service docks at Long Wharf at Perrotti Park in Newport. The ferry makes six round trips to Providence daily. Any delay in schedule for any trip would affect the schedule throughout the day as only one vessel is in service on this route.

The Jamestown-Newport Ferry leaves Jamestown, with a travel circuit that includes Rose Island, Fort Adams, Bowen's Wharf, Perrotti Park, and Goat Island. The schedule includes seven weekday trips, with one additional trip on weekends.

The Prudence Island Ferry provides lifeline service from Church Street wharf in Bristol to Homestead Dock at the north end of Prudence Island. This ferry operates year-round and averages 40 to 50 persons per trip during the peak season. Four round trips daily are scheduled with additional evening trips on weekends. The ferry is the only means of access (other than private boat) to this Portsmouth island.

Fishing and Cruising Charters

The Rhode Island Charterboat Association reports that they are part of the Coast Guard Auxiliary based out of Warwick and East Greenwich and teach environmental safety in the harbor.

The fishing charter fleet operating out of Newport Harbor and Castle Hill includes 15 boats. Most have two trips daily during the eight-week season. Destinations include inshore and Narragansett Bay waters. (J. Flaherty, 8/11/05)

SightSailing of Newport currently has three boats going out daily (5 trips per day on average). The operating manager reports that approximately 10,000 passengers cruise on his boats annually. (SightSailing, 7/11/05) The *Aurora* sails twice daily from May to October with anywhere between two and 80 passengers. The *Amazing Grace* with capacity for 80 passengers, sails seven times daily.

Newport Events

Newport hosts a wide range of social and cultural events every year. These events have helped to secure the local economy and make Newport the national and international destination that it is today. These activities include sports events, music events, and "mansion-oriented" programs. The Newport County Convention and Visitors Bureau maintains a robust roster of tourism-related activities. The Newport Music Festival, the Dunkin Donuts Folk Festival, and JVC-Jazz Festival Newport are scheduled during the summer months. Sports events include Newport International Polo Series, the Wooden Boat Show, Campbell's Hall of Fame Tennis Championships, Museum of Yachting 12 Meter Regatta, and the Newport International Boat Show. Additional events include the Newport International Film Festival, Newport Flower Show, Newport Gulls Baseball Club, Old Colony Scenic Railroad, and the Tall Ships, scheduled for 2007.

Cruise Ships/Goat Island Anchorage

Cruise ship arrivals represent a small but important component of the local economy. As indicated in Table 7, 31 cruise ships are scheduled to call in Newport in 2005. September and October are popular months for cruise ship arrivals, sometimes with two or three per day. (E. Smith, 7/8/05)

Table 7: Newport Cruise Ship Arrivals, 2005

Date	Line	Ship
May 5		*Staad Amsterdam*
July 11	Holland America	*Maasdam*
August 22	Holland America	*Maasdam*
September 9	Princess	*Golden Princess*
September 9		*Saga Ruby*
September 12	Cunard	*Queen Elizabeth 2*
September 13	NCL	*Norwegian Jewel*
September 14	Seabourn	*Seabourn Pride*
September 16	Crystal	*Crystal Symphony*
September 16	Princess	*Golden Princess*
September 18	Crystal	*Crystal Symphony*
September 23	Princess	*Golden Princess*
September 25	Princess	*Sea Princess*
September 30	Princess	*Golden Princess*
October 1	Seabourn	*Seabourn Pride*
October 7	Cunard	*Queen Mary 2*
October 7	Princess	*Golden Princess*
October 8	Crystal	*Crystal Symphony*
October 9	Silver Sea	*Silver Whisper*
October 13	Princess	*Sea Princess*
October 14	Princess	*Golden Princess*
October 15	Princess	*Sea Princess*
October 15	Seabourn	*Seabourn Pride*
October 15	Crystal	*Crystal Symphony*
October 16	Princess	*Golden Princess*
October 17	Crystal	*Crystal Symphony*
October 17	Seabourn	*Seabourn Pride*
October 24	Holland America	*Maasdam*
October 26		*The World*
October 30	Princess	*Sea Princess*
November 1	Crystal	*Crystal Symphony*

Source: Newport County Convention and Visitors Bureau

Emergency Access

The Town of Portsmouth provides emergency service from the pier at Sandy Point on Prudence Island to Melville. Approximately 50 emergency runs are provided annually. Emergency service is also provided to Hog Island. The Portsmouth Fire Department provides this service. (Portsmouth Fire Department, 7/11/05)

Museums and Organizations

The Rose Island Lighthouse's function is to maintain navigational safety in the East Passage, and as such, it is critical to the safety of LNG transit as well as recreational and other commercial use of the bay. The lighthouse is open to the public as a museum by day in the summertime. About 5,000 visitors come to Rose Island annually, many via the Jamestown-Newport Ferry. The other months of the year, transportation for overnighters is provided aboard the Rose Island Lighthouse Foundation's boat *Starfish* with a route from Goat Island to Rose Island. (C. Johnson, 7/22/05) At night, lodging is available year-round in one of two keeper's

bedrooms. Newport Harbor Seal Watches benefit Save the Bay and the Rose Island Lighthouse Foundation. Two departures daily are scheduled aboard the *M/V Alletta.*

Representatives of the International Yacht Restoration School stressed that the most important part of southern Rhode Island's economic well-being is based on tourism and related trades occurring in and around the Narragansett Bay. (T. Nathan, 7/12/05)

Naval Underwater Warfare Center (NUWC)

NUWC conducts tests of or with unmanned undersea vehicles, unmanned surface vehicles, torpedoes, and other surface and undersea self propelled and/or towed vehicles on the Navy's range in Narragansett Bay several times per week. From fiscal year 2003 to present, the frequency of this test activity has been on the order of three to four test events per week, with the preponderance of the tests occurring within the confines of the range as defined on NOAA nautical charts as follows: northeast of Jamestown and southwest of Prudence Island, including waters around Gould Island as Restricted Area 334.80 and in the East Passage of Narragansett Bay adjacent to Restricted Area 334.80. NUWC's estimated projection of test events and range utilization in fiscal years 2006 and 2007 indicate that these figures will increase to five to seven events per week. As indicated in Table 8, the majority of NUWC exercises are conducted in the East Passage.

Table 8: NUWC Exercises

Fiscal Year	Total Number of Runs	Total Runs in East Passage
2003	206	196
2004	147	140
2005	199	189
2006	281	267
2007	381	362

Source: NUWC, draft August 4, 2005 correspondence

Section 4
Economic Considerations and Impacts to Recreational and Commercial Boating

Bay Tourism and the State and Local Economy

Narragansett Bay is one of Rhode Island's primary economic assets. Its value to marine recreation, tourism and events, fisheries and aquaculture, boatbuilding, boating-related businesses, shipbuilding, marine transportation, military and marine research, technology and education have been well documented. The State of Rhode Island has advanced several recent initiatives to capitalize on the importance of the bay, not just on a quality of life basis for its residents, but also as a major economic driver. The Governor's Narragansett Bay Summit 2000, followed by the Marine Cluster report, prepared by the Rhode Island Senate Policy Office in 2002, and more recent economic analyses conducted by the University of Rhode Island Department of Environmental and Natural Resources Economics, all document the value of the Bay to the state and local economy.

Waters off Newport in the East Passage represent some of the most important recreational resources of Narragansett Bay. Although the East Passage represents a relatively small portion of the bay itself, the steady breezes, dramatic shoreline, extensive water areas and navigational challenges, together with a protected harbor with full services and landside amenities have demonstrated that Newport is the focus. Newport's reputation is widely known nationally and internationally. As Jay Gowell, founder and director of the Rhode Island Sailing Foundation indicates, "Yachtsmen worldwide may not know where Rhode Island is but they know Newport."

Consider the following statistics supporting the importance of Narragansett Bay and the waters off Newport to the local and state economy:

Tourism and the State Economy

- The economic value of Narragansett Bay exceeds several billion dollars per years, regardless of the approach used to estimate it. The economic value of five marine-related sectors of the Rhode Island economy totaled $426 million in 1997:
    - Tourism and recreation - $140 million
    - Government activity - $118 million
    - Fisheries - $103 million
    - Transportation - $58 million
    - Construction - $6 million (Narragansett Bay Journal, 2003)

- The total annual value of all outdoor recreation activities in the state is $6.7 billion (Narragansett Bay Summit 2000, Marine Recreation and Tourism White Paper):
    - The total annual value of all outdoor recreation activities associated

with the marine aquatic and shoreline environments is $4.3 billion.
  - The total annual value of Bay-related outdoor recreation activities is $2.0 billion.

- The demand for marine recreational opportunities will likely grow substantially in the coming decades. Travel and tourism could become Rhode Island's largest employer by 2015. (Narragansett Bay Summit 2000, Marine Recreation and Tourism White Paper)

- According to "The Economic Importance of Narragansett Bay" (Tyrell, Devitt and Smith), 30 percent of tourism revenues were attributable to Bay-related uses and attractions. In 1999 dollars, it is estimated that $800 million in annual revenues are generated as a direct consequence of Bay-related uses and attractions. (Narragansett Bay Summit 2000, Marine Recreation and Tourism White Paper)

- Rhode Island's travel and tourist industries contribute approximately 5 percent of its Gross State Product. (Tyrrell, 2004)

- In 1998 travel and tourism accounted for 8.5 percent (390,000) of the state's private sector jobs. In 1998, about 14.2 million travelers visited Rhode Island for business, conventions or leisure. (Narragansett Bay Summit 2000, Marine Recreation and Tourism White Paper)

- 36 percent of state residents participate in ocean-related activities annually. (Tyrrell, 2004)

Tourism and the Local Economy

- The impact of marine recreation and tourism on local communities is significant. The three Aquidneck Island communities account for 15.0 percent of the state tourism industry wages and 10.9 percent of output or revenue. (Tyrrell, 2004)
  - In Newport, the tourism industry generates $89.89 million in annual wages with $262.91 million in output. In the state, these figures are only surpassed by Providence and Warwick.
  - In Middletown, the tourism industry generates $25.18 million in annual wages with $109.81 million in output. Although Middletown lacks public access to the East Passage, many of the goods and services required by Newport tourists are found in Middletown, and many tourism-related employees live in this town.
  - In Portsmouth, the tourism industry generates $9.74 million in annual wages with $37.35 million in output.

- At least 30 percent of Rhode Island's tourist industry revenue depends on marine resources. Newport, Middletown and Portsmouth have high dependence on marine resources, based on the number of boat ramps, slips, beachfront, and access points with parking. (Tyrrell, 2004)

LNG Economic Impact

The following subsections describe the impact of LNG tanker transit on recreational boating, commercial boating, emergency response, museums and NUWC as it pertains to Aquidneck Island communities. The preliminary investigation of the relative economic impact of LNG tanker transit is based on discussions with those who live or work on Aquidneck Island or sail off Island waters. LNG transit may be expected to affect the local economy of Aquidneck Island communities in the following ways:

- Actual costs would result from fuel expenditures during delays, lost time for commercial fishermen, ferry, fishing charter, tour boats, and cruise ships and revenue lost if schedules are cancelled.

- Asset utilization costs would result if fishing, tourism, recreational and other resources are not fully realized due to delays and loss of access. Loss of access to lobster traps and fishing grounds would result in an asset utilization cost for fishing. Delay and detours would result in asset utilization costs for recreational use of the bay for pleasure or competition. Detours and delays for land-based tourism attractions and Newport events would result in reduced attendance that could decrease use of these assets in the future. Potential conflicts between NUWC exercises and LNG tanker transit could also result in asset utilization costs to the Navy.

- Opportunity costs are opportunities lost or precluded in the future. Any impact that would result in less than fully planned development of O'Neill Properties Group at Carnegie Abbey, including Carnegie Village and Marina and the 1,400-slip marina permitted at Portsmouth's Weaver Cove, would represent a critical opportunity cost to the Town of Portsmouth.

Impacts to Tax Base and Life-style Residential Development

Communities on the East Passage are defined by their waterfront and the recreational use offshore. It is important to the City of Newport and Towns of Portsmouth and Jamestown that the value of waterfront property be maintained and continues to appreciate into the future. Existing and proposed seasonal properties are a component of the tax base that requires few municipal services.

Jay Gowell, a founder and director of the RI Sailing Foundation, has indicated that the reputation of Newport could be significantly affected by a hard to quantify "fear factor" of people not wanting to be anywhere near something so big and potentially devastating as an LNG tanker. This perception may have an intangible "chilling effect" on the value of the Bay as a recreational and economic resource. LNG tanker transit safety and security zones with picket boats, bullhorns, and potential traffic delays could adversely affect the psyche of the rest-seeking tourist and therefore the continued ability of Newport to attract vacationers. (J. Gowell, 7/28/05)

Lifestyle residential development of second and third homes has increased in recent years, especially in Portsmouth. The O'Neill Properties Group has made an initial

investment of $250 million in construction of Carnegie Tower, Carnegie Village, and Carnegie Marina (proposed). Full build-out of these developments with construction of Portsmouth's Weaver Cove marina (permitted) and associated high-end residential development could be approximately $750 million (K. Hively, 8/12/05). Potential investors may choose not to be inconvenienced by views of tankers, tug boats, and increased commercial traffic associated with one-way traffic patterns. Picket boats with loudspeakers and aerial surveillance could increase noise levels and reduce privacy as the safety and security zone approaches. Access from the proposed marina at Willow Lane would be prohibited during the 36-minute period that it would take an LNG tanker safety and security zone bound for Weaver's Cove Energy to pass. (Access to and from this proposed marina would not be blocked by KeySpan LNG transit). As a result of Weaver's Cove LNG tanker transit, O'Neill's development in the Carnegie Abbey area may become less attractive to the high-end market, one that has options regarding where it will spend its money. Any loss of full development would have implications to the Town of Portsmouth that could anticipate annual receipt of $4 million in tax revenue with full buildout (East Bay Newspapers, 7/21/05).

Other shoreline areas of Portsmouth include the neighborhood at Common Fence Point with views of Mount Hope Bay. This area will also be subject to safety and security zone closures with LNG tanker transport to Fall River. Residents will be inconvenienced by minimum delays of 67 minutes for access by water to the East Passage when LNG tanker transport occurs.

Impacts to Recreational Boating

Of leisure/vacation visitors to the state, boaters average expenditures per day were $97.98 in 2001. (Tyrrell, 2004)

There is the perception among those interviewed that LNG transit, especially to Weaver's Cove Energy in Fall River, will adversely affect the appeal of Newport and East Passage waters along Middletown and Portsmouth for recreational boating. In addition to safety concerns that were expressed by many interviewed during the course of the study, marina operators, marine service providers, yacht club representatives, and others indicated that the uncertainty of the LNG delivery schedule, the lack of advance notice, and anticipated delays will definitely affect marine businesses.

Michael Keyworth from Brewer's Cove Haven Marina pointed out that boats are much different from homes. If you are unhappy with conditions where you cruise, you can move your boat to a different, unaffected marina. (M. Keyworth, 7/18/05). Although there will be sailing enthusiasts who will never leave Newport Harbor, there are others who will be much more intolerant of changing conditions. As these people relocate their boats, the local marine and landside economy will suffer. As the volume of LNG transport increases in the future, the impact to the boating community would continue to acerbate.

The peak recreational boating season is short, extending 120 days between June and October. Any situation or event that reduces boaters' ability to fully utilize this resource results in an underutilization of assets. An 18 minute delay has been cited

in the FEISs for passage of the LNG tanker safety and security zone. For a boater coming into Narragansett Bay from off-shore with a destination such as Brewer's Sakonnet Marina in the Sakonnet River near Mount Hope Bay, transit time could actually extend to nearly three hours as the boat trails behind the security zone at 10 knots and then at 5 knots northward from Sandy Point. For a boat that typically cruises above 10 knots, this constraint would significantly affect boaters' perspectives regarding use of Narragansett Bay. In the future this would lead to a diminished utilization of the bay as a recreational asset. (K. Hively, 7/22/05)

Waters west of Gould Island (east of Jamestown) and on the Sakonnet River would become more popular for sailing and cruising as these areas are not restricted by the safety zone.

Impacts to Regattas and Sailing Events

Special events and regattas play a prominent position in the local economy of Aquidneck Island. As indicated in Section 3, five or six major regattas are scheduled in Newport annually. The following is an indication of the importance of these competitions and other major events to the local economy:

- The Newport to Bermuda race generated an estimated $6.5 million gross economic impact in Rhode Island in 1992 (adjusted to 2005 dollars: $9 million). Direct expenditures from hotel rooms to boat supplies, were estimated at more than $31,000 per boat in 1992 (adjusted to 2005 dollars: $43,000). In 2002 the fleet for this race was the largest ever, with almost 200 yachts. (Newport Bay Journal, Spring 2002)

- The Around Alone race, a single-handed around-the world race with origins in Newport, re-established its ties to Newport for the event's 20th anniversary in 2002. With many race budgets in excess of $1 million, the 20-plus fleet made a significant economic impact on the local and state economy. (Newport Bay Journal, Spring 2002)

- Local "megayacht" (power yachts of 100 feet or more) events include the Megayacht Challenge and the Newport Bucket. Robin Wallace of the State Yachting Committee reports that boats this size can have an enormous economic impact. A 1998 Florida study estimated that megayachts contributed $500 million per year to the economy of three south Florida counties. (Newport Bay Journal, Spring 2002)

- The 1989 International Boat show had a $9 million gross economic impact. (The Marine Cluster, 2002)

The Aquidneck Island economy is integrally dependent upon high-end recreational boating and tourism as indicated in Section 3 and as demonstrated in the statistics

above. The State of Rhode Island, through the Rhode Island Sailing Foundation, Senate Policy Office, and other groups, has actively marketed the Newport area to attract major regattas, Tall Ships, and various sailing competitions and events in recognition not only of Newport's America's Cup heritage, but with an understanding of the significant positive impact these venues have on the state and local economy. Newport faces stiff competition from other communities both in the US and abroad for many of these events. An intangible risk or fear associated with LNG transit may impact planning for these events.

Disruption of sailing events strikes at the very heart of the Newport economy. Any disruption of a regatta or other major event with an LNG transport would have significant consequences to the ability of Newport to retain the event in the future or to attract other events. Although the US Coast Guard and the Northeast Marine Pilots Association make every effort to adjust schedules to accommodate both commercial and recreational users of the bay, any inconvenience to race participants is not easily forgotten. (J. Gowell, 7/8/05) With limited one-hour or less notification of an LNG tanker transit, it is very difficult to assure that regattas will not be disrupted. This is an especial concern of the Ida Lewis Yacht Club. (ILYC, 6/27/05) The suddenness and unannounced nature of the LNG tanker movements are also of major concern insofar as they would inevitably disrupt and delay sailboat racing events that are highly scheduled and operate on a very tight timeframe. (J. Gowell, 7/28/05)

Impacts to the Fishing Fleet

Rhode Island's commercial fishery landings are valued at $75 million annually, of which about $10 million is harvested from Narragansett Bay. The value of Rhode Island's seafood industry, as a whole, is estimated at $750 million per year. The state's aquaculture industry produces more than $200,000 worth of shellfish per year. (Narragansett Bay Summit 2000 Report)

Any situation that would reduce a fisherman's ability to access traps or lines would result in a diminished utilization of fishing resources. Prime lobster beds east of Prudence Island (see Figure 3), would not be as well tended, with a lower resultant yield. Access to aquaculture leases off Burma Road in Middletown would be less accessible with imposition of LNG tanker safety and security zones. Delays associated with waiting for the passage of the LNG tanker safety and security zone are addressed below, in Fuel Costs.

Impacts to Ferry Operations

The Jamestown-Newport Ferry reports that there is no question that LNG transit, especially to Weaver's Cove Energy, would adversely affect their service, schedule and route. Connections between Jamestown and Newport would be subject to more than 18 minute delays in travel from Jamestown, south to Newport Harbor, especially with any congestion that might result east and west of the safety and security zone. (B. Munger, 7/18/05)

Transit of an LNG tanker to Weaver's Cove Energy would not affect the Prudence Island ferry from Bristol to Homestead Dock. KeySpan LNG tankers, however,

could delay the Prudence Island ferry for a minimum of 18 minutes.

Michael Glasfeld, President of New England Fast Ferry, operators of RIPTA's Newport to Providence ferry, sees no negative impact to ferry service from LNG tanker traffic in the bay, even if there are two or three tankers per week during his scheduled service. He said his ferries have shallow draft and can generally avoid the security zone around the ships. He runs ferry services in Boston Harbor when the LNG tankers come through. He thinks there may be some delays to his service for the first few large tanker trips, but believes the US Coast Guard and commercial boating interests will make adjustments which will limit the effect to his regular service. Due to his schedule being pre-programmed, the US Coast Guard will know when his ferries are coming through, and may be able to adjust the security zone to allow him passage. He said his customers are mostly tourists who enjoy seeing the big ships while underway. (M. Glasfeld, 7/1/05)

Impacts to Charters and other Seasonal Tourism-based Businesses

Newport is the home of many tourist-based businesses on Newport Harbor. Fishing charters, cruises, ferry service, tender service, boatyards, and other services are components of the marine economy. Many operators have indicated that since LNG transit will not be routinely scheduled (for security purposes one hour or less notice may be given as a Notice to Mariners), their tour schedules could easily be disrupted. Although some routes could be adjusted, the delay involved could adversely affect the ability of small operators to attract the customer base that is critical to their viability. Many tourism-based workers live in Newport and Middletown and any loss of employment would adversely affect other areas of the economy in these communities.

Although there is generally a shortage of available slips and moorings in Newport Harbor, the operator of Conanicut Marine Services has indicated his concern that with LNG the area will no longer be considered a destination location or a prime location to moor your boat. He was adamant that LNG transit would impact the economic viability of the bay and surrounding waters. (B. Munger, 7/18/05)

The average direct expenditures by all anglers (in-state and out-of-water) have been estimated by others to be about $54.01 per saltwater fishing trip. This does not include related expenditures such as investments in boating equipment and travel expenditures. (Narragansett Bay Summit 2000, Marine Recreation and Tourism White Paper) Fishing charter operators have indicated a similar concern to many interviewed regarding the effect of safety and security zones, estimated time delays, and schedule disruption. (J. Flaherty, 8/11/05) Any decrease in participation in this sport would affect the local economy.

SightSailing of Newport reports that LNG proposals are detrimental to the safety of Newport Harbor's people, businesses, events, and environment. (SightSailing, 7/11/05) A representative of the *Aurora* has indicated that they would not be able to charter the Aurora if an LNG tanker transit is scheduled. (*Aurora*, 7/13/05)

A representative of *Amazing Grace* Harbor Tours has indicated that LNG transit would make it difficult to schedule mooring work, repair work and towing. Tour

boats go out seven times per day with 80 passengers. It would be impossible to schedule around tankers, especially if one cannot know in advance when they are coming. The entire day's schedule of departures could be disrupted at least two days a week. This is totally unacceptable to this operator who wonders, "Why would someone go to Newport when there are so many other places not dealing with LNG?" (Oldport Marine, 7/13/05)

Impacts to Cruise Ships

Transport of LNG through waters off Newport Harbor could have a major impact on cruise-ship tourism. The majority of cruise ships (27 of 31 in 2005) call in Newport in September and October, as indicated in Table 6. LNG tanker transports would be increasing during these months, especially October, as the heating season increases demand on energy. Potential conflicts could arise more often than twice per week with inbound and outbound LNG tanker transit. The LNG tanker safety and security zone encompasses all of Anchorage D as indicated in Figure 2, the designated area for cruise ship mooring on the west side of Goat Island. With a cruise ship at the mooring, it would not be possible to secure a safety and security zone for LNG tanker transit. Based on the unannounced schedule of LNG tanker transits, the US Coast Guard may not be able to adequately schedule both LNG tanker transit and cruise ship arrivals and departures. Newport's reputation as a cruise ship destination could therefore diminish as cruise lines seek other more reliable ports of call.

Each cruise ship passenger spends an average of $105 in port. Each cruise therefore generates $60,000 for the local economy or $6.5 million per year. Cruise lines pay a landing fee of $4 per passenger to the City of Newport. With an average of 600 passengers per ship for 31 arrivals in 2005, the City of Newport stands to collect nearly $75,000 this year in landing fees. The loss of cruise ships would therefore affect the municipal budget as well. (E. Smith, 7/7/05, E. Lavalle, 8/3/05)

Impacts to Emergency Access

Both Prudence and Hog Islands are part of the Town of Portsmouth. The town provides emergency response to the Sandy Point town dock on Prudence Island and to the ferry dock at Hog Island via the municipal boat docked at Melville. This boat is used to transport patients from the islands to an ambulance for transport to local hospitals. Although it would be hoped that the US Coast Guard Captain of the Port would permit emergency response vessels within the safety and security zone, a passing LNG tanker safety and security zone could delay response to or from these islands between 18 and 36 minutes for this lifeline service. Any security zones established around an LNG tanker moored while awaiting clearance for an outbound commercial ship could also affect emergency response to the islands. Since emergency response may be required at any time of the day or night, year-round, outbound LNG tanker safety and security zones could delay this service as well. These conflicts could increase in the winter as LNG fuel delivery increases.

Impacts to Museums and Organizations

Terry Nathan of the International Yacht Restoration School reports, "The most important part of southern Rhode Island's economic well being is based on tourism and related trades. In my personal view, nothing is more antithetical to this than the proposed use of the Bay for transporting highly hazardous materials, especially when such transports require a disruption to the natural flow of activities---even if such transports are at ebb hours. The attractiveness of our precious water resources is based not just on protecting them and the people who live and visit nearby, but on the perception that the public has about safety and desirability. Currently, we share these resources with industry. There is an important balance that works. I believe that if LNG is allowed to use these same waters to transport the proposed new materials, the balance will be tipped. I am against this undue risk." (T. Nathan, 7/18/05)

As indicated in Figure 2, the LNG tanker safety and security zone includes Rose Island. If the Jamestown-Newport Ferry cross-bay schedule is affected by LNG transit it will definitely impact the Rose Island Lighthouse Foundation's ability to attract visitors to the lighthouse. Another question raised by the Rose Island Lighthouse Foundation is whether having visitors on the island would pose a security risk to LNG transit. The foundation is concerned that they could be required to conduct security checks of visitors, or be asked to vacate the island or limit activities in any way when the LNG tankers are passing. (C. Johnson, 7/22/05) These would all have impacts on the viability of the Rose Island Lighthouse Foundation's efforts to fund preservation efforts.

Impacts to Naval Undersea Warfare Center (NUWC)

NUWC's range generally extends northeast of Jamestown and southwest of Prudence Island, including waters around Gould Island and in the East Passage of Narragansett Bay (identified on NOAA nautical charts as Restricted Area 334.80). Nearly 1.7 square miles of Restricted Area 334.80 is located within the proposed LNG tanker safety and security zone.

Donald Aker, NUWC Technical Manager, reports that the proposed LNG safety and security zones, the proposed frequency of LNG transit through the Narragansett Bay range, and the lack of firm and available scheduled LNG tanker passage through this area, could significantly impact NUWC exercises in the short term. LNG tanker passage through the range (see Section 3) would effectively halt any tests planned or in process and, depending on the timing, could result in the cancellation of the test and financial losses for the Navy in terms of non-recoverable sunk costs associated with planning and staging these complex test events. The biggest impact will be lack of notice of LNG passage as a result of needing to maintain security. If DIVNPT were given significant notice of greater than two weeks of the LNG passages in Narragansett Bay it would allow options to plan around their presence. Without this notice a cancellation of a single event could result in a loss in excess of $50,000. The long-term impact of continued passage through the Navy's range and the resultant interruption and/or cancellation of tests has the potential to impact

NUWC's mission, namely the ability to develop, test, and deliver viable undersea warfare weapon systems to the US Navy. (NUWC, draft 8/4/05 correspondence)

The continued viability of NUWC and Naval Station Newport is critical to the economy of the State of Rhode Island (its value to the state is reported to be between $4 and $5 billion). Any activity such as LNG transit, which could adversely affect the ability of NUWC to undertake its mission, would adversely affect the entire state.

Fuel Costs

The cost of fuel associated with delay for safety and security zones has been calculated, based on the methodology used in RIDOT's Sakonnet River Bridge EIS Marine Navigation Study (RIDOT, 2000). The following is based on boat counts conducted at Fort Adams, Pell Bridge and Melville on Friday, June 24, and Saturday, June 25, 2005, as presented in Appendix 2. The following assumptions have been made to calculate costs:

- Time of delay is 18 minutes or .3 hours on the East Passage. Figures should be increased proportionately for minimum delays outlined in Table 1 (36 minutes between Sandy Point and Mount Hope Bridge and 67 minutes between Mount Hope Bridge and Common Fence Point in Mount Hope Bay).
- Diesel is consumed at the rate of 1 gallon per hour per 20 horsepower.
- Gasoline is consumed at the rate of 1 gallon per hour per 15 horsepower.
- Both diesel and gasoline consumption rates are based on operating at 75 percent power (although this was appropriate for navigational detours for Sakonnet River Bridge construction, this figure could be high for LNG delays).
- Assumed price per gallon of diesel and gasoline to be averages of prices at Brewer's Sakonnet Marina and Goat Island Marina on July 12, 2005.
- Boats do not turn off engines while waiting for the security zone to pass.
- The distribution of diesel and gas power is similar to the Sakonnet River (based on DEM boat registration information gathered for the Sakonnet River Bridge EIS Marine Navigation Study).
- Average motorboat is powered by a 200 horsepower motor; the average sailboat has a 25 horsepower motor; the average large yacht or commercial boat has a 500 horsepower engine.

The following is a sample calculation for gasoline-powered motorboats for the weekday count conducted from 6:45 to 7:45 AM:

*# of boats (average HP per boat) (% of Boats with diesel engines)(.3 hours delay)(gallons/hour*horsepower)(price per gallon of fuel) = cost in fuel of delay*

8 Boats (200 HP per boat) (.74 percent diesel boats) (.3 hours) (1 gallon/ hour /15 HP) ($3.09 price per gallon) = $73.41

Table 9 presents costs per delay period for motorboats, sailboats, commercial boats (including large yachts), and total fuel cost for an 18-minute delay within a two-hour period, based on boat counts conducted at the location and time periods indicated. This information is presented to provide a guide for what the fuel cost only would be for a typical 18-minute delay during a peak summer weekday or

weekend period. As indicated, the price of delay in fuel consumption only, would range from $124 to $1,055 per delay.

Table 9: Cost of Fuel for Safety and Security Zone Delay (18 minutes)

Date	Friday, June 24, 2005						Sat. June 25, 2005					
Location	Fort Adams		Pell Bridge		Melville		Fort Adams		Pell Bridge		Melville	
Time	6:45 to 7:45 AM		9:30-10: 30 AM		12:45-1:45 PM		Noon - 1:00 PM		1:30-2:30 PM		4:25 –5:15 PM	
	Diesel	Gas	Diesel	Gas	Diesel	Gas	Diesel	Gas	Diesel	Gas	Diesel	Gas
Motorboats	$11.23	$73.41	$32.29	$211.05	$15.44	$100.94	$101.09	$660.67	$129.17	$844.19	$47.74	$311.98
Sailboats	$1.84	$1.61	$3.67	$3.22	$1.38	$1.21	$17.90	$15.72	$34.43	$30.23	$5.97	$5.24
Commercial and Large Yachts	$20.25	$15.50	$20.25	$15.50	$20.25	$15.50	$91.13	$69.75	$10.13	$7.75	$40.50	$31.00
TOTAL	$123.84		$285.99		$154.72		$956.25		$1,055.89		$442.43	

For areas north of Sandy Point where the LNG tanker would transit at 5 knots, the costs would double (at a minimum, but more likely be three or more times higher in Mount Hope Bay).

Costs per 18-minute delay per boat range from $1.40 to $9 for motorboats to $8 to $10 for a large yacht or 500-horsepower commercial boat. With a 67-minute delay costs would range up to $34 for a gasoline-powered motorboat to between $29 and $38 for a diesel or gasoline powered commercial boat or yacht.

As evidenced by the data above, the effect of unannounced LNG tanker transit, with its 3.2-mile long by 1.2-mile wide safety and security zone, will have a substantive impact on the economy of Newport, Aquidneck Island, and the State of Rhode Island. When combined with vehicular traffic impacts resulting from bridge closures and with the general anxiety associated with safety, LNG tanker transport has the potential to also affect the marine-oriented way of life for residents of Aquidneck Island communities.

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Appendix 1
Key LNG Tanker Transit Findings: Final Environmental Impact Statements

Two Liquid Natural Gas (LNG) import terminal facilities have been proposed for new or upgraded service in areas that could have a profound impact on users of the bay:

- **Weaver's Cove Energy, L.L.C.** proposes new construction of an import terminal and natural gas pipeline facilities at Weaver's Cove, Fall River, MA. The Federal Energy Regulatory Commission (FERC) approved this proposal on June 30, 2005. The applicant has prepared a Final Environmental Impact Statement (FEIS) / Environmental Impact Report in accordance with National Environmental Policy Act / Massachusetts Environmental Policy Act requirements. Docket Nos. CP04-36-000, CP04-41-000.

- **KeySpan LNG, L.P.** proposed upgrade of the existing terminal at Fields Point in Providence. This proposal was rejected by FERC on June 30, 2005, following the NEPA Final EIS review process. Although this project was rejected, it has been included in the analysis pending any appeals. Docket No. CP01-223-000, CP04-293-000, CP04-359-000.

The following are key findings as LNG transit affects marine navigation on the East Passage of Narragansett Bay. These findings are based on the Final EISs for the two LNG projects, the Letter of Intent to Operate a Newly Constructed Waterfront Facility for KeySpan LNG, L.P. (prepared by Moffat & Nichol International), and information presented by Weaver's Cove Energy, L.L.C. at an August 3, 2005 presentation to the Newport City Council. Many findings are similar for both facilities, as indicated. It is also noted that the safety and security zone (exclusion zone) referenced within this appendix is not based on 33 CFR 165.121, Safety and Security Zones: High Interest Vessels, Narragansett Bay, Rhode Island calculation of the safety and security zone. Page references to documents are included (WC is the Weaver's Cove Energy FEIS; K is the KeySpan FEIS; MNI is the Moffat & Nichol Letter of Intent).

LNG Transit

Tanker Size

- LNG will be delivered to the terminal in LNG tankers having capacities from 70,000 to 145,000 cubic meters of LNG (MNI 5 of 26). Typical dimensions of LNG tankers that will call at the KeySpan facility are indicated in Table A-1.1. As indicated by a representative of Weaver's Cove Energy at the August 3, 2005 Newport City Council meeting, Weaver's Cove Energy LNG tankers may be larger: 930 feet in length and 150 feet in width with 37 feet of loaded draft.

Frequency of Shipments

- Weaver's Cove Energy – 50 to 70 inbound LNG tankers per year or one every five to seven days (more frequent when energy demand is highest, in the winter).
- KeySpan – 50 to 60 inbound LNG tankers per year or one every six to seven days (more frequent when energy demand is highest, in the winter).

Table A-1.1: Detail of LNG Carriers

Capacity of vessel	145,000 Cubic meters	88,000 Cubic meters	71,600 Cubic meters
Example Vessel	*Energy Frontier*	*Hoegh Galleon*	*Newbuild*
Overall Length	909 feet	818 feet	721.6 feet
Beam	142 feet	131 feet	114.8 feet`
Loaded Draft	37.4 feet	34.8 feet	32.1 feet

Source: LOI to Operate a Newly Constructed Water Facility, KLNG Terminal, Providence, RI (MNI 5 of 26)

Waterway Channels Used

- Weaver's Cove Energy
  - From the mouth of Narragansett Bay, the LNG tankers would proceed up the East Passage to Sandy Point (east side of Prudence Island). At Sandy Point, the LNG tankers would turn east and follow the Federal Navigation Channel through Mount Hope Bay and up the Taunton River to the LNG terminal site.
  - At least initially, LNG tankers in this segment may be restricted to one-way traffic and daylight only transit. The Federal Navigation Channel has an authorized depth of 35 feet and a minimum width of 400 feet. The channel was originally dredged in 1920 and was last maintained in the 1970s. Weaver's Cove Energy proposes to conduct maintenance and improvement dredging of the federal navigation channel to accommodate deeper draft LNG tankers.
  - A tractor tug would escort the LNG tankers up Narragansett Bay to Sandy Point where two additional tractor tugs would join the escort up the Federal Navigation Channel. (WC 4-254)
- KeySpan
  - From the mouth of Narragansett Bay, the LNG tankers would proceed up the East Passage of Narragansett Bay, Federal Channel, through upper Narragansett Bay to Providence. One-way operation would be in effect (see Moving Safety and Security Zones, below).
  - A tractor tug would escort the LNG tankers to Providence. Transit to KeySpan would NOT be subject to rising tide restrictions required for transit to Weaver's Cove Energy.

Tidal Restrictions and Vessel Travel Time

- As the LNG tanker bound for either LNG facility arrives at the Pilot Station off the coast, the pilot and the US Coast Guard will determine the best time to bring the LNG tanker to port with due consideration given to security concerns, the impact on users in the Bay, and environmental data for the projected period of the port call.
- Weaver's Cove Energy
  - 4 hours for a 21- nautical mile transit from RI Sound to the terminal (WC 4-170, WC 4-270). The outbound trip is slightly faster as a result of increases in the average speed. Table A-1.2 presents information on distance, average speed, and estimated time of travel.
  - "LNG tankers would enter the channel *(Federal Channel north of Mount Hope Bridge)* during a rising tide to ensure sufficient water depth for safe passage." (WC 4-254, clarification added) "Channel transits would be undertaken on a rising tide and timed to minimize current effects in the area of the Brightman Street Bridge." (WC 4-265).

Table A-1.2: Transit Time to Weaver's Cove Energy

Direction	Begin	End	Distance nautical miles	Average Speed knots	Estimated Time (1) minutes
Inbound	Entry of Narragansett Bay (2)	Pell Bridge	3.9	10	23
	Pell Bridge	Sandy Point	6.4	10	38
	Sandy Point	Braga Bridge	8.6	5	103
	Braga Bridge	Turning Basin	2.0	3	40
Outbound	Turning Basin	Braga Bridge	2.0	3	40
	Braga Bridge	Sandy Point	8.6	6	86
	Sandy Point	Pell Bridge	6.4	10	43
	Pell Bridge	Entry of Narragansett Bay (2)	3.9	12	20

(1) Estimates based on a 145,000 cubic meter LNG tanker
(2) Crossing line between Beavertail Point and Breton Point
Source: WC 4-188

- "Weaver's Cove Energy has indicated that it would be willing to consider limiting LNG tanker transits during peak weekend hours and using early morning periods, *subject to tidal conditions.* With the agreement of the Coast Guard and pilots, Weaver's Cove Energy would also explore the possibility of eventually using nighttime transits for the LNG tankers to minimize impacts on recreational boating." (WC 4-170, emphasis added)
- "The LNG tanker would normally transit Narragansett Bay during daylight hours." (WC 4-254) "Existing practice is for deep draft vessels to transit the channel only during daylight hours." (WC 4-265)

- KeySpan
  - LNG tankers may proceed regardless of tide (due to deepening of the channel) or light conditions, based on discussion with the Coast Guard. However, LNG tankers must wait at the bay's entrance for acceptable visibility (greater than 2 miles). (MNI LOI 16 of 37).
  - Transit time to Keyspan: 3 hours for a 29-nautical mile trip inbound. It has been proposed that the transit times of the LNG tankers will be scheduled in the early morning or at night, outside the normal peak periods of usage of the waterway by recreational boaters.
    - A typical transit schedule to and from the KeySpan terminal in Providence may be as follows (K 4-138):
    - LNG tanker arrives at dawn at the Pilot Station south of Newport, picks up the pilot and heads in around 0600
    - LNG tanker passes Newport during early morning hours around 0700 to minimize the impact of the Safety and Security Zone to recreational boating in the Newport area
    - LNG tanker berths at KLNG Terminal (KeySpan, Providence) between 0830-0900
    - LNG tanker commences cargo discharge operations around 1200
    - LNG tanker completes cargo discharge operations – around 0100 next morning
    - LNG tanker departs the berth and heads down river around 0430 – night time transit most of the way
    - LNG tanker transits Narragansett Bay and passes Newport area prior to 0630 to minimize the impact on recreational boating in the Newport area in summer time
    - LNG tanker drops off pilot and takes departure around 0700
- LNG tankers, after unloading, can transit from berth irrespective of tide or daylight. (MNI LOI 17 of 37)

Moving Safety and Security Zone

Safety and security zones apply to both the Weaver's Cove Energy and KeySpan LNG facilities, for both inbound *and outbound transit*, at the discretion of the US Coast Guard (USCG) Captain of the Port:

- Two miles ahead of the vessel, one mile behind, and 1,500 feet on either side for inbound traffic. (WC 4-270). This area is indicated in Figure 1 as a moving "exclusion zone" which proceeds along the East Passage, to the Federal Channels to Providence and Fall River.
- Currently, a moving safety and security zone is utilized for Liquefied Petroleum Gas (LPG) shipments. An average of 10 to 12 ships per year typically unload 20,000 to 30,000 metric tons of LPG per visit at Providence, with most visits occurring from fall to late winter. All transits entering from Narragansett Bay at Breton Point are subject to special safety and security measures imposed by the Coast Guard. (WC 4-263).
- "A detailed security plan describing the resources and prevention/mitigation strategies has been provided to the FERC. The plan includes an offshore security sweep by a Coast Guard boarding team, aerial surveillance, and an

escort to the dock by armed security boats to enforce a safety and security zone." (WC 4-269)

Safety Zone Notification

- "To mitigate the impacts of security zones, the Coast Guard would routinely provide Notice to Mariners prior to the arrival and departure of LNG tankers as the Coast Guard currently does for LPG vessels and/or other activities such as the Tall Ship parades. The notification system employed for safety and security zones consists of broadcasts on radio frequencies used by mariners. This notification may be given from minutes to more than 1 hour before the security zone is enforced. Broadcasts are intentionally not made further in advance for security reasons. *(Note: Notices to Mariners are generally read by pilots of commercial vessels but not readily available to recreational boaters.)* Picket boats would also precede the LNG tanker to inform vessels of the approaching security zones." (WC 4-272)
- "The notification system includes broadcasts on radio frequencies used by mariners and loudspeaker announcements from USCG, police or other agency picket boats that precede the ship." (WC 4-310)

Safety and Security Zone Delay

- "Operation of the LNG terminal could also affect recreational boating and fishing during the weekly transit and unloading of the LNG ships. In many areas, the waterway that would be traveled by the LNG ships is sufficiently wide to allow recreational craft, which generally are not confined to the Federal Channel, to navigate around the LNG ships without significant delay. To estimate what kind of delay might result from a passing LNG ship in areas where the waterway is narrower, we identified the locations where the moving safety and security zone has the greatest potential to encompass the entire width of the waterway. We specifically looked for areas where there might be less than approximately 1,500 feet of open water on both side of the LNG ship route (the anticipated width of the safety and security zone on either side of the ship). *These areas include the East Passage between Newport and Jamestown, the Mount Hope Bridge area,* and the Taunton River. For an LNG tanker in transit at 10 knots *(East Passage)*, recreational craft attempting to travel in the opposite direction at a narrow location may need to wait *up to 18 minutes* for the LNG ship to pass before proceeding on its way. For an LNG tanker in transit at 5 knots *(Sandy Point, Mount Hope Bridge, Mount Hope Bay)*, recreational vessels may be delayed for *up to 36 minutes*." (WC 4-273, emphasis added)
- "The extent of the impact on recreational boaters would depend on the number of boats in the project area during the 50 to 70 days per year that LNG tankers would call on the LNG terminal. These impacts would primarily occur during the peak recreational boating season between about May and September. As noted above, the Coast Guard is expected to use a program of announcements to give advance notice of approaching LNG ships. Weaver's Cove Energy has stated that it is willing to consider limiting ship transits during peak recreational traffic weekend hours and

using early morning periods, *subject to tidal conditions.* With the agreement of the Coast Guard and the pilots, Weaver's Cove Energy would also look to eventually using nighttime transits for the LNG ships, which would further reduce the impact to boaters." (WC –4-273, emphasis added)

Narragansett Bay Navigation

Visibility

- Visibility must be at least two miles for the estimated duration of a LNG tanker's journey for the LNG tanker to be allowed to enter the bay or sail off from berth. (MNI 7 of 26)
- NMI indicates that fog typically prohibits navigation from about 2 am until noon, about twice a month during the winter months (November through March) and about twice a week from April through July. (MNI 8 of 37)

One-way Vessel Traffic System

- "A one-way system will be enforced throughout the bay and rivers when an LNG carrier (KeySpan or Weaver's Cove Energy) transits to or from its berth. Specifically, while a KeySpan carrier is traveling to (from) its terminal, all Providence Harbor outbound (inbound) traffic in the river or bay is delayed and any Fall River harbor outbound (inbound) traffic that would otherwise meet the carrier south of the Hope Bay turn-off is also stopped. Similarly, while a Weaver's Cove Energy carrier is traveling to (from) its terminal, all Fall River outbound (inbound) traffic in the river or bay is delayed and any Providence Harbor outbound (inbound) traffic that would otherwise meet the carrier south of the Hope Bay turn-off is also delayed. *It is assumed that the LNG carriers do not have any special priority over other vessels, thus they must wait for other vessels to complete their journey in the opposite direction; there will be no clearing of traffic in the opposing direction ahead of the LNG carrier's arrival to reduce its potential delay.*" (MNI LOI 16 of 37, emphasis added, WC 4-265)
- Based on the "one-way rule" above, the waters off Sandy Point on Prudence Island would be used to hold waiting LNG tankers for transit to either Providence or Fall River.
- "It is estimated that the delay to a ship scheduled to depart from an existing Fall River berth due to inward passage of an LNG ship in the navigation channel could be between 60 and 90 minutes." (WC 4-265)

LNG Shipping Simulation (commercial vessels, only)

- Commercial traffic entering Narragansett Bay averages roughly two to three commercial vessels per day. This includes tankers, coal ships, LPG ships, car carriers, passenger/cruise ships, and general cargo. (WC 4-263)
- Impacts are projected to range from delay to 3 percent of commercial vessel traffic under current conditions to delay of 8.4 percent of commercial traffic for the scenario with increased vessel traffic and increased LNG activity at both the Key Span and Weaver's Cove Energy terminals. This analysis, conducted by MNI, was prepared for KeySpan. (MNI 8 of 26)

- "Although the traffic impacts due to ships proposed for the Weaver's Cove Energy project were not studied separately, these ships would be expected to have *less* impact than the analysis for the Keyspan LNG Facility Upgrade Project." (WC 4-272, emphasis added). Reference is to the MNI study, above.
- Recreational boat traffic impacts were not projected for either LNG facility.
  - "Recreational boating traffic was not included in the shipping traffic simulations. The impact of a transit of a loaded KeySpan vessel on recreational boating would be limited to one a week. A proposal to schedule early morning or night-time transit, outside the normal peak periods of recreational usage of the waterway, would minimize the once-weekly impact." (KeySpan LOI, 9 of 26).
  - "Recreational boats were not included in the simulation; however, it can be assumed that the impacts on recreational boaters would be less than on deep draft vessels since recreational boats have shallower drafts and are less restricted on where they can travel in the bay and river." (WC 4-309)

Appendix 2: East Passage Boat Counts

Boat counts were conducted during a weekday and weekend period to document use of the East Passage for recreational and commercial boating. Both counts were conducted during fair early summer weather. Weekday counts were conducted from 5:45 AM to 1:45 PM to observe commercial fishing boats and general recreational use. Weekend counts were conducted between 10:00 AM and 5:15 PM to observe maximum recreational use. Counts were conducted for a total of six hours on each day with two hours of counts at three locations: Fort Adams, Pell Bridge, and Melville. Recreational boats were identified as motorboats, sailboats, or large yachts. Commercial boats were categorized as ferries/cruise boats, fishing boats, or other (including commercial tankers).

As indicated in Table A-2.1, 129 boats were observed passing count stations on Friday, June 24 during a six hour period between 5:45 AM and 1:45 PM and 565 boats were observed on Saturday, June 25 between 10:00 AM and 5:15 PM. Of the total traffic observed, 89% was recreational on the weekday count and 98% was recreational on the weekend count. These counts do not include the general observations to the north or south of the count location (see Table A-2.1 notes). Boat counts are graphically presented in Exhibit 1.

Table A-2.1: Boat Counts, June 24 and 25, 2005

Date	Friday, June 24, 2005						Saturday, June 25, 2005					
Location	**Fort Adams**		**Pell Bridge**		**Melville**		**Fort Adams**		**Pell Bridge**		**Melville**	
Time	0545-0645	0645-0745	0830-0930	0930-1030	1145-1245	1245-1345	1000-1100	1200-1300	1230-1330	1330-1430	1515-1615	1615-1715
Recreational Boats												
Motorboats	10	8	23	23	14	11	45	72	78	92	34	22
Sailboats	2	4	2	8	3	3	29	39	27	75	13	19
Yachts	1	1	0	0	2	0	4	4	1	1	1	0
Total Recreational Boats	13	13	25	31	19	14	78	115	106	168	48	41
Commercial Boats												
Ferry/cruiser	1	0	1	1	1	1	0	4	1	0	1	0
Fishing	1	0	2	0	0	0	0	0	0	0	1	0
Other	1	1	0	1	2	1	0	1	0	0	1	0
Total Commercial Boats	3	1	3	2	3	2	0	5	1	0	3	0
TOTAL BOATS	**16**	**14**	**28**	**33**	**22**	**16**	**78**	**120**	**107**	**168**	**51**	**41**
North Observations	Dead (1)	Dead (2)	Dead	Dead (3)	Dead (4)	Dead (4)	Busy (6)	Busy (6)	Busy (8)	Busy (8)	Slow (9)	Slow (11)
South Observations	Dead	Dead	Dead	Dead	Dead (5)	Dead (5)	Busy (6,7)	Busy (6,7)	Busy (8)	Busy (8)	Slow (10)	Dead (12)

Notes:

(1) One sailboat observed at dock across passage and one boat fishing under the Pell Bridge

(2) Two boats fishing under Pell Bridge

(3) Three sail boats off in distance

(4) Yacht driving in circles, couple of jet ski's across passage

(5) Couple of sailboats in distance past Pell Bridge

(6) 10-15 sailboats in sight, 5-10 power boats in sight

(7) People fishing off Fort Adams

(8) Boats and sailboats everywhere

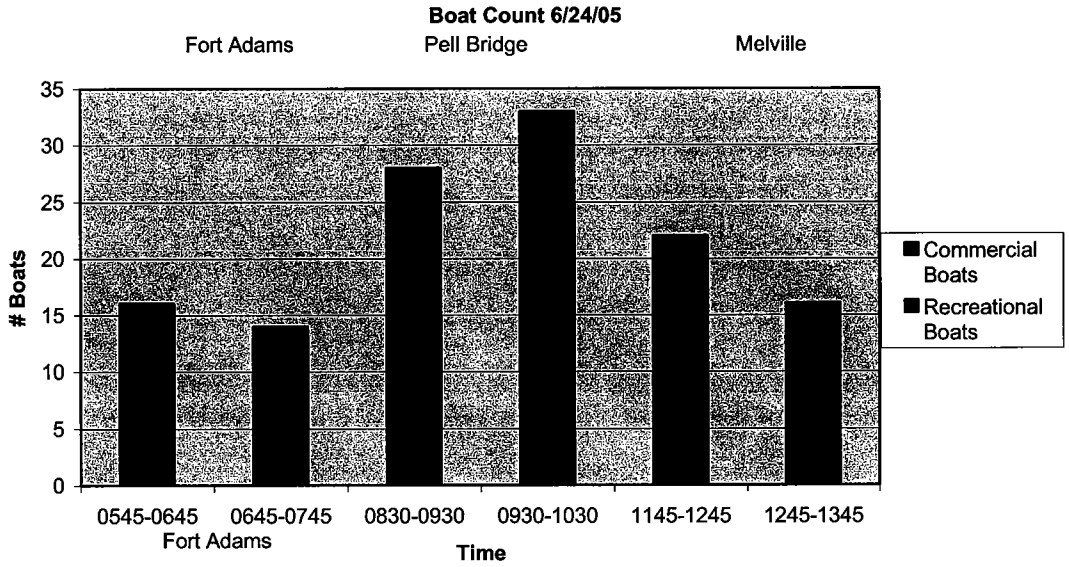
(9) Many sailboats in sight

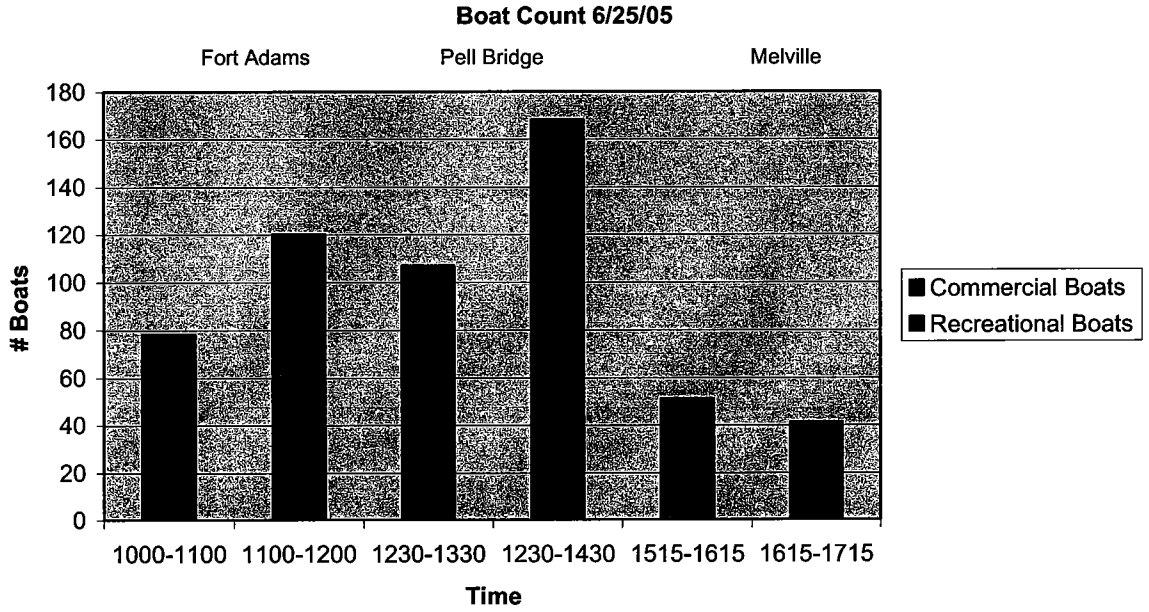
(10) Few boats near shore, few sailboats in sight

(11) Only a few sailboats in sight

(12) Couple of boats in sight

Exhibit 1: East Passage Boat Counts





projo.com
The Providence Journal

Weaver's Cove rejects LNG impact studies

The company says that two reports issued Tuesday projecting ecomomic harm to Aquidneck Island are based on incorrect assumptions.

01:00 AM EDT on Saturday, August 27, 2005

BY TIMOTHY C. BARMANN
Journal Staff Writer

Weaver's Cove Energy said two studies released this week concluding that LNG tankers traversing Narragansett Bay would hurt the Aquidneck Island economy and cause traffic delays are based on "fundamentally flawed" assumptions.

The company, which has been given federal approval to build an LNG terminal in Fall River, was responding to two reports issued Tuesday by the Aquidneck Island Planning Commission.

One report, prepared by Pare Engineering Corp., of Lincoln, concluded that regular shipments of LNG through the East Passage of Narragansett Bay could hurt tourism and marine activities in Newport.

The other report, by the Needham, Mass.-based Louis Berger Group, said that LNG tanker shipments would cause bridge closures and could have a severe impact on automobile traffic and delay emergency vehicles.

The two reports were paid for by the planning commission at a cost of about $30,000, according to Tina Dolen, the group's executive director.

A letter written to Dolen by Ted Gehrig, president of Weaver's Cove Energy, said the two reports contain errors that invalidate their conclusions.

The letter highlighted what Gehrig called two "egregious" mistakes: a misrepresentation of the security zone around LNG tankers, and an inaccurate assumption that the Pell and Mount Hope bridges would be closed whenever LNG tankers pass beneath them.

Weaver's Cove has proposed 50 to 70 LNG deliveries a year, which means that tankers, coming and going, would pass through local waters roughly two to three times a week.

LNG tankers entering Narragansett Bay would be surrounded by a security zone in which no other boats would normally be allowed. Weaver's Cove said the Pare report used a

security-zone measurement that was too big -- by a factor of two.

The Pare report does accurately report the size of the security zone for a "high-interest vessel," such as an LNG tanker, according to the rules issued by the Coast Guard.

That moving zone extends 2 miles in front of a tanker, 1 mile behind it and 1,000 yards on either side.

However, a report by the Federal Energy Regulatory Commission suggests that the security zone would probably become narrower: 500 yards on either side.

That's the distance currently enforced by the Coast Guard for high-interest vessels in Narragansett Bay, according to a Final Environmental Impact Statement on the Weaver's Cove project, issued by the FERC.

The federal agency drew up the smaller security-zone dimensions after holding workshops with federal, state and local law-enforcement and industry officials. The participants included the Coast Guard, which issues and enforces the security-zone regulations.

The security zone "isn't as critical an issue as some people seem to think it is," said Capt. Mary Landry, chief of marine safety and security in the First Coast Guard District.

The Coast Guard, she said, can modify the existing zone to be consistent with the distances recommended by the FERC. Or it can write a new security zone specifically for LNG operations, Landry said.

Additionally, the Coast Guard can allow, on a case-by-case basis, certain vessels to pass within the security zone, Landry said.

While the security zones are strictly enforced, "there are certain things that can take place in that zone" with the permission of the captain of the port, she said.

"There's flexibility in that regulation to allow for certain dynamics on the waterfront," Landry said.

"You can't be so rigid that everything comes to a halt."

Pam Sherrill, principal planner for Pare and author of the report, said the report was "a valid perspective" on how LNG tankers would affect marine traffic.

"When our client asked us to look at what the impacts are, I can't, in good faith, do that impact assessment based on what the applicant wants [the security zone] to be," she said. "I have to go by what is the federal law right now."

Sherrill said an earlier draft of the report did use the narrower security-zone dimensions, and she said the resulting disruptions to Bay traffic were similar.

The primary reason marine traffic would be disrupted is not the size of the security zone, she said, but rather that LNG shipments would not be announced until an hour or so before they arrive.

"The fact is that it's an unannounced security zone that will take people by surprise," she said.

"Tour-boat operators, fishing charters, ferry-boat operators will miss a certain number of their trips."

Gehrig, of Weaver's Cove, also criticized the vehicle-traffic report by the Berger Group, which found that LNG tankers could delay traffic on the Pell Bridge by as much as 26 minutes, and on the Mount Hope Bridge by as much as 47 minutes.

The report assumed that both bridges would be closed for all LNG shipments.

The Rhode Island Turnpike and Bridge Authority, which oversees both bridges, announced in June that it would close the bridges anytime an LNG tanker passed beneath them.

Gehrig said the authority made that determination even though federal regulators said the bridges didn't need to be routinely closed, but rather when there was a "threat condition."

That recommendation was made in consultation with the Coast Guard, the state police, the Rhode Island Department of Environmental Management, the FBI, the Northeast Marine Pilots and the Turnpike Authority, Gehrig said.

The bridge authority is directed by a five-member board, four of whom are appointed by the governor.

Governor Carcieri is among the vast majority of public officials who oppose the local LNG projects.

Gehrig said the Berger study didn't investigate the discrepancy between the findings of the FERC and the decision by the Turnpike and Bridge Authority board.

He also said that the report "grossly exaggerates" the potential impact of bridge closures. He suggested that if a bridge were closed, it might affect traffic for only a minute or two, instead of the 16.5 minutes estimated by the Berger report.

Timothy C. Barmann covers energy issues, utilities and technology. He can be reached at tbarmann [at] projo.com

Rhode Island Turnpike and Bridge Authority
LNG Terminal Resolution
June 14,2005

WHEREAS, The Rhode Island Turnpike and Bridge Authority (RITBA) has been given the authority under Title 24-12 of the Rhode Island General Laws to maintain and operate the Claiborne Pell Newport Bridge and the Mount Hope Bridges; and

WHEREAS, RITBA has a long history of maintaining and operating these two bridges in a secure and cost efficient manner that is convenient for the motoring public; and

WHEREAS, efforts to build a liquefied natural gas (LNG) terminal in The Port of Providence and/or in Massachusetts at Weavers Cove involve LNG tanker traffic under and around one or both of our bridges; and

WHEREAS, The issue of the safety and security of moving large amounts of liquefied natural gas through coastal waters has not been sufficiently taken into account; and

WHEREAS, The movement of tankers carrying large amounts of liquefied natural gas under or in proximity to the bridges will require the closure of the structures; and

WHEREAS, the closure of these structures creates an economic drain on the RITBA's finances by causing motorists to seek alternate routes; and

WHEREAS, The closure of these structures creates a safety hazard by delaying emergency vehicles, such as ambulances from crossing in a timely fashion; and

WHEREAS, maintaining the security, both real and perceived, of these structures is a particular challenge when large amounts of liquefied natural gas is passing under and around these bridges.

NOW THEREFORE BE IT RESOLVED, that the Rhode Island Turnpike and Bridge Authority hereby objects both the Port of Providence and the Weaver's Cove projects and urges the Federal Energy Regulatory Commission (FERC) and all other regulatory bodies, local, state and federal to reject these liquefied natural gas terminal proposals.

PASSED AND APPROVED THIS 14TH DAY OF JUNE IN THE YEAR OF 2005.

Attest:

Secretary Kenneth M.Bianchi

Chairman David A. Darlington

UNITED STATES OF AMERICA

BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

WEAVER'S COVE ENERGY, LLC AND MILL RIVER PIPELINE, LLC	)	**Docket Nos. CP04-36-000; CP04-41-000; CP04-42-000; CP04-43-000**

AFFIDAVIT OF PETER M. JANAROS

I, PETER M. JANAROS, upon oath do depose and make affidavit as follows:

1. I am a Registered Professional Engineer and have worked on transportation issues for almost thirty years.

2. I have had extensive training in security issues, particularly when I was on active duty responsible for Titan II missile systems for the United States Air Force.

3. I am currently the Director of Engineering for the Rhode Island Turnpike and Bridge Authority ("RITBA") and have been in that position since July of 2001.

4. RITBA is responsible for all aspects of safety, security, operation, and maintenance of the Claiborne Pell Newport Bridge ("Newport/Pell Bridge") and the Mount Hope Bridge.

5. In my capacity as Director of Engineering for RITBA, I am responsible for engineering issues related to the Newport/Pell and Mount Hope Bridges; and I provide recommendations to the RITBA Board of Directors concerning bridge safety and security. Over ten million vehicles passed over the Newport/Pell Bridge during fiscal year 2004.

6. It is estimated that over six million vehicles passed over the Mount Hope Bridge during fiscal year 2004.

7. Emergency vehicles, including advanced-life support vehicles, basic ambulance transportation, police, fire and rescue vehicles routinely use both bridges.

8. I attended several workshops chaired by the United States Coast Guard on safety and security issues associated with the proposed liquified natural gas ("LNG") facility in southeastern Massachusetts at Weaver's Cove, and I reviewed the information and plans presented in the workshops.

9. Through the presentations I attended, I learned that the LNG tankers will make approximately fifty to seventy trips per year by and under the Newport/Pell and the Mount Hope Bridges translating into as many as one hundred and forty passages per year beneath each bridge.

10. The RITBA Board of Directors is concerned that it will be particularly difficult during rising tides for pilots to safely maneuver LNG tankers through the Newport/Pell and Mount Hope Bridges due to the size of the tankers and the height and width clearances for each bridge.

11. In the past there have been serious collisions with vessels hitting the Newport/Pell and Mount Hope Bridges, and the number of LNG tankers passing through the bridges will increase the risk of collisions resulting in damage to the bridges.

12. The LNG tanker traffic under and or in proximity to the Newport/Pell and/or Mount Hope Bridges poses serious safety and security issues for the operation, maintenance and management of these bridges.

13. The Board of Directors is aware that the Final Environmental Impact Statement ("FEIS") for the LNG facility at Weaver Cove states that "a moving safety and security zone would restrict other vessels 2 miles ahead, 1 mile behind and approximately 1,500 feet on either side of the LNG vessel."

14. The Board of Directors is aware that the Coast Guard is responsible for the control and safety of the water while the Board is responsible for the safety and security of both the Newport/Pell and Mount Hope Bridges.

15. The Board of Directors takes issue with Pages 4-270 to 4-271 of the FEIS, which states that "[w]hile bridge closures are one of the many tools available to the Coast Guard, it should not be assumed that routine bridge closures would be mandatory: Other alternatives to a complete bridge closure under consideration include closing the outbound lanes only, placing law enforcement officials on the bridge at strategic locations or employing technology that provides suitable security alternatives."

16. The Board of Directors is responsible for the safety and security of the bridges and is gravely concerned about its responsibility and liability relating to the passage of LNG tankers in proximity to and under the Newport/Pell and Mount Hope Bridges.

17. The Board of Directors has determined through its resolution dated June 14, 2005, that the movement of tankers carrying large amounts of LNG under or in proximity to the bridges will require the Newport/Pell and Mount Hope Bridges to be closed to vehicular traffic before, during and after each tanker passes by and through the bridges.

18. The Board of Directors has determined through its resolution passed on June 14, 2005, that the closure of the bridges can be expected to create safety hazards, including delays in the response times of emergency vehicles, including advanced life support vehicles, basic transporting ambulances, police, fire and rescue vehicles.

18. The Board of Directors has determined that the closure of the Newport/Pell Bridge will include all lanes of traffic, not just the outer lanes of traffic.

19. The Board of Directors will determine the length of each bridge closure and other necessary safety and security measures due to the passage of LNG tankers.

20. Frequent closures of the bridges will cause motorists to seek alternative routes and such closures of the Newport/Pell Bridge are likely to adversely impact toll revenues received by RITBA.

21. The passage of up to one hundred and forty tankers of LNG per year in proximity to and under the bridges will make it very difficult and costly to maintain the security of the bridges and the infrastructure of which they are a critical part.

22. Security cameras, underwater sweeps of the bridges and/or anti-swimmer technology may be required on a continuous basis for safety and security purposes.

23. Maintenance and repair is performed on the bridges on an ongoing basis and the movement of tankers carrying large amounts of LNG under or in proximity to the bridges will require work on the bridges to stop for some period of time before, during and after a tanker passes through the area.

24. Work stoppages due to LNG tanker traffic will interfere with maintenance and repair of the bridges, delay projects, and increase the cost of the work.

25. The RITBA has a ten-year renewal and replacement plan that governs the costs of maintenance, safety and security of the bridges.

26. The 10-year plan does not include the additional costs of maintenance, safety, or security measures that may be incurred due to the passage of LNG tankers in proximity to and under the bridges; and RITBA does not have funds available for such costs.

Peter M. Janaros, P.E.
Director of Engineering

Dated: August 11, 2005

STATE OF RHODE ISLAND
COUNTY OF NEWPORT

Subscribed and sworn to before me this 11 day of August, 2005.

Notary Public
My Commission Expires: 2-7-08